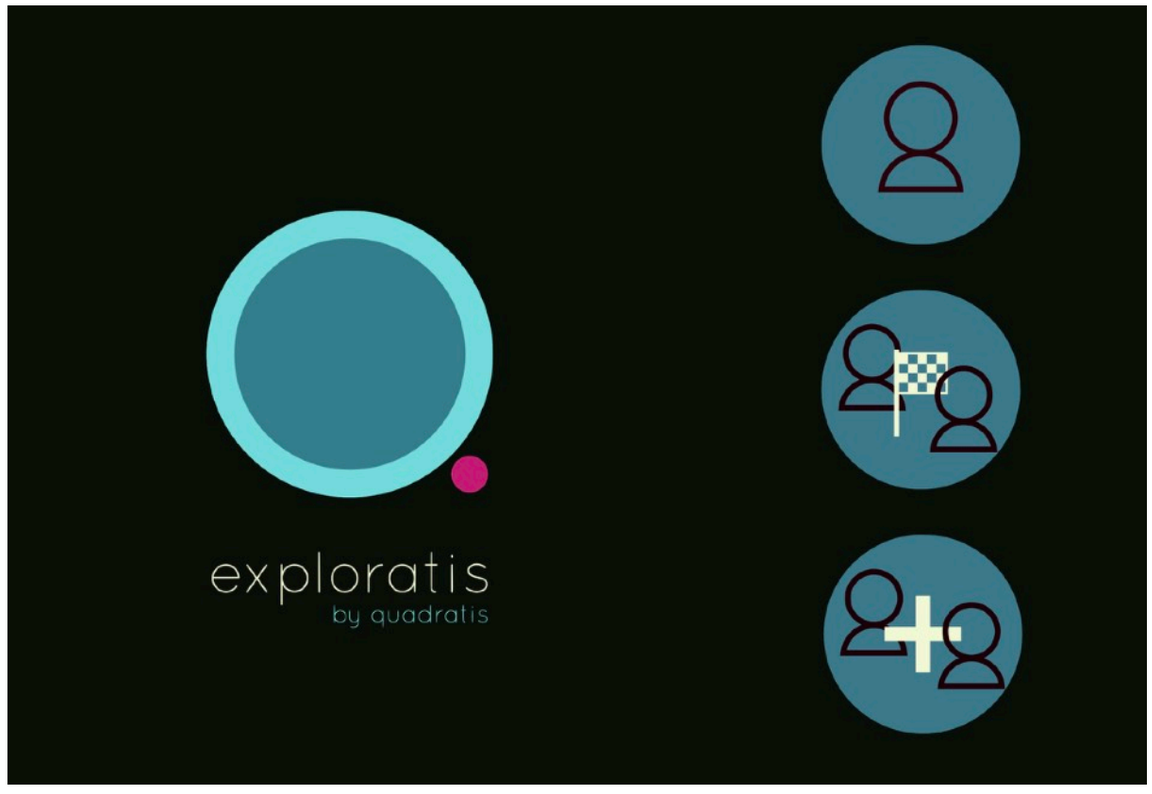
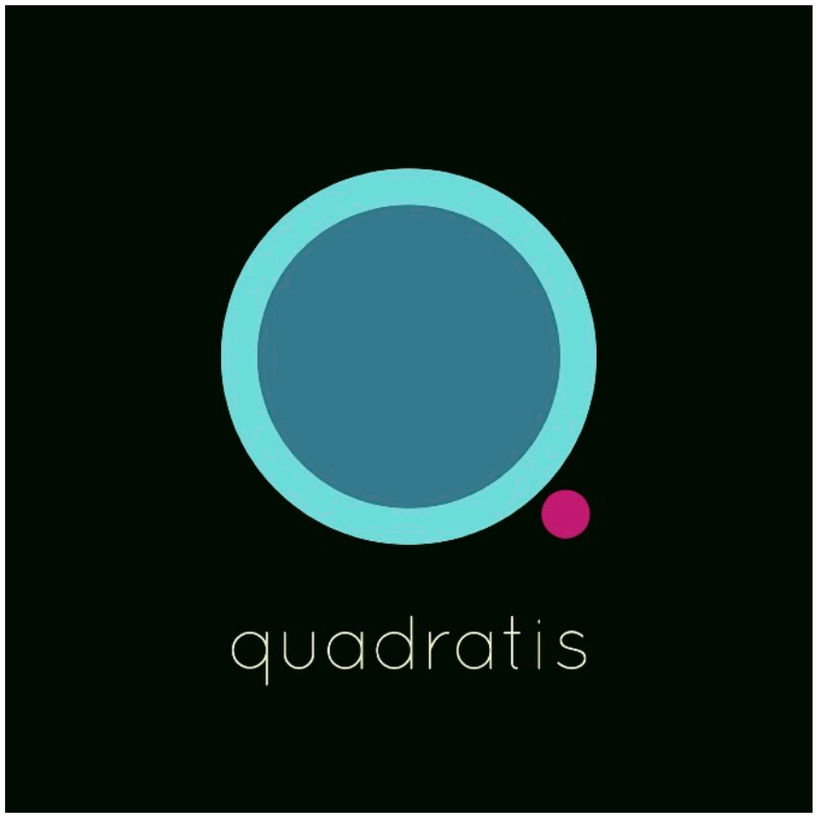
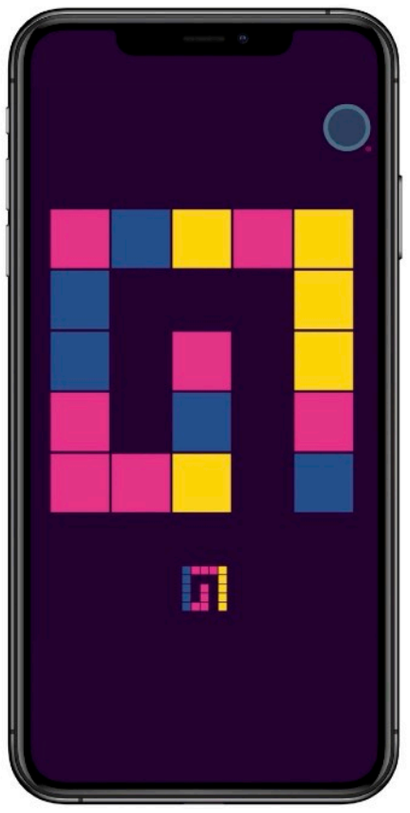
Exploring Quadratis Puzzles

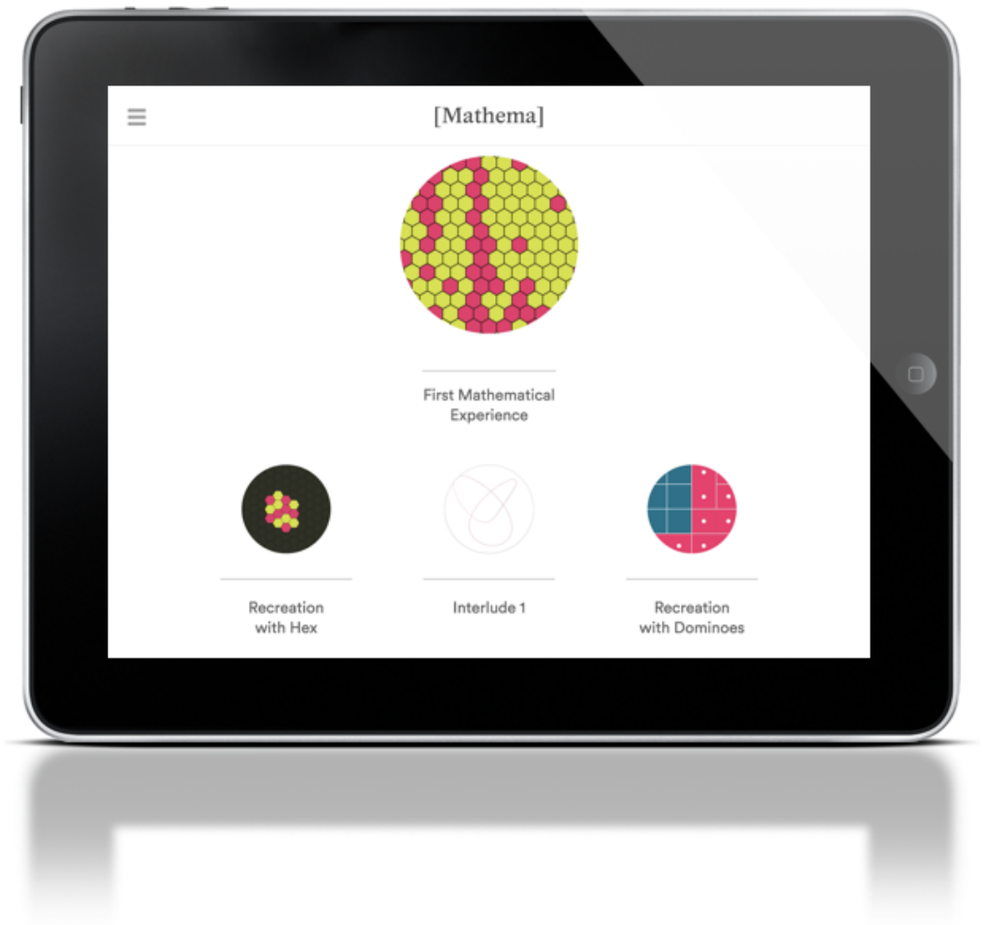
Hugo Parlier (Luxembourg)
Paul Turner (Geneva)


exploratis
by quadratis


quadratis



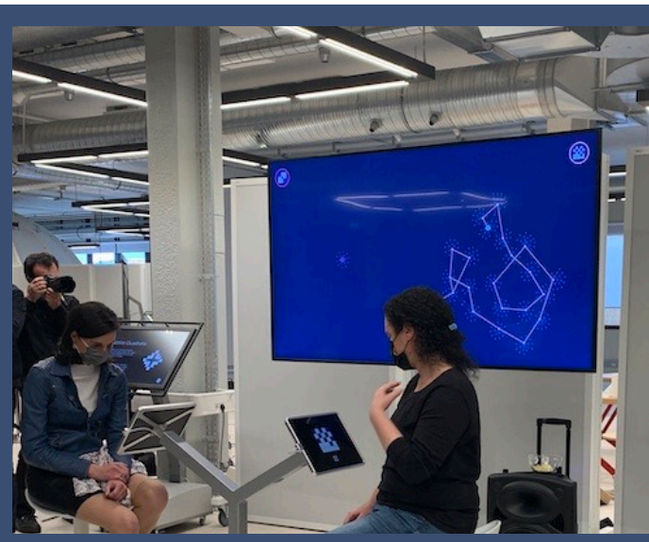

Puzzle completed
Time: 0m 8.93s
Moves: 12
Score:

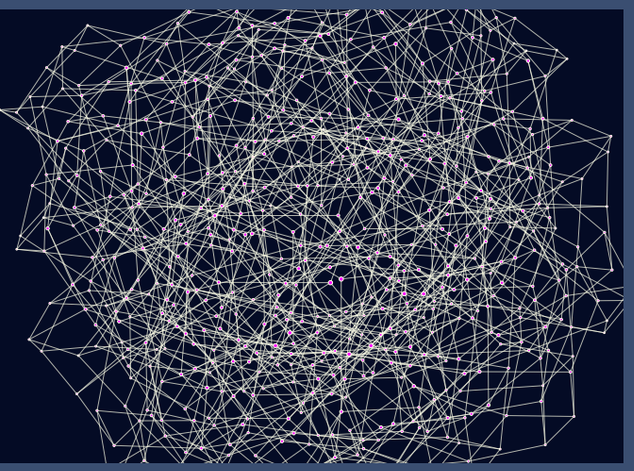

[Mathema]
First Mathematical Experience
Recreation with Hex
Interlude 1
Recreation with Dominoes

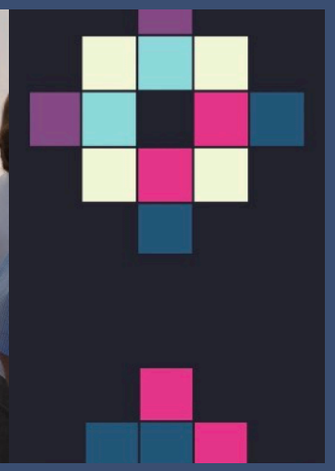
Mit einer App die Welt der Mathematik entdecken

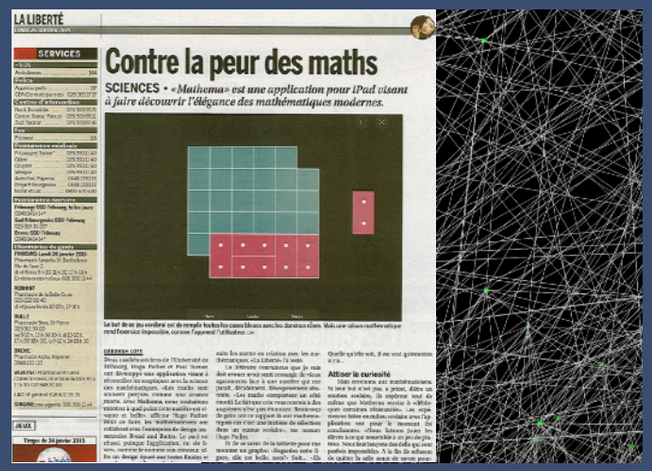
Die Applikation Mathema der Universität Freiburg ermöglicht das spielerische und interaktive Erlernen von Mathematik.

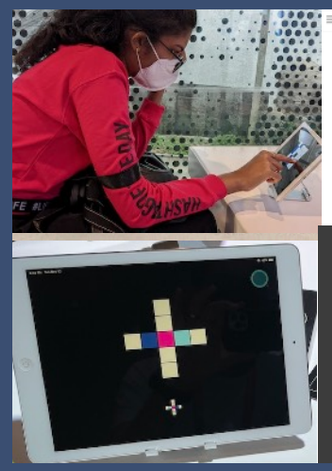
FREIBURG Mit einer neuen Applikation für Smartphones will das Departement für Mathematik der Universität Freiburg laut einer Mitteilung Menschen die Angst vor dem Rechnen nehmen. Die App heisst Mathema und ist auf dem Appstore und später auf Google play erhältlich. Sie kombiniert Texte, Bilder, Videos sowie Spiele und führt auf unterhaltsame Weise in die Welt der Mathematik ein. Zu Beginn war die App für Jugendliche und Erwachsene vorgesehen, nun gibt es Anwendungen für alle Altersgruppen. Die Mathematiker Hugo Parlier und Paul Turner haben die App entwickelt. Der Auslöser war laut Parlier die Erkenntnis, dass der schulische Ansatz nicht immer ein angemessenes Bild der Mathematik vermittle. Diese habe das Image, schwer kommunizierbar zu sein. Ag

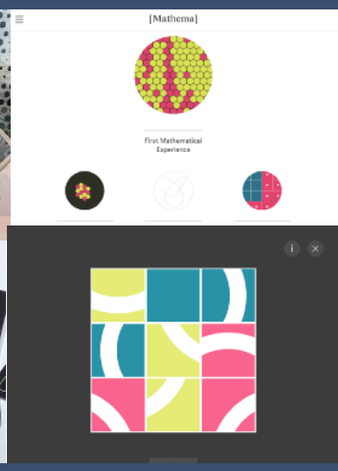


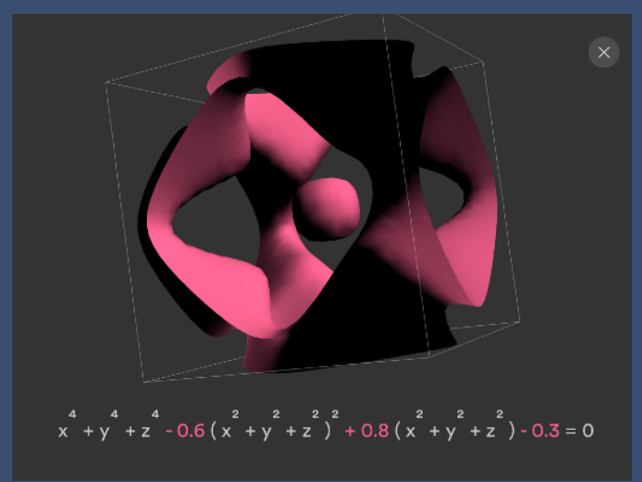












Key elements:

- engage with authentic mathematics or authentic processes of mathematics
- do not compromise with design
- use the technology in a genuine, intelligent way

Wishlist of ingredients:

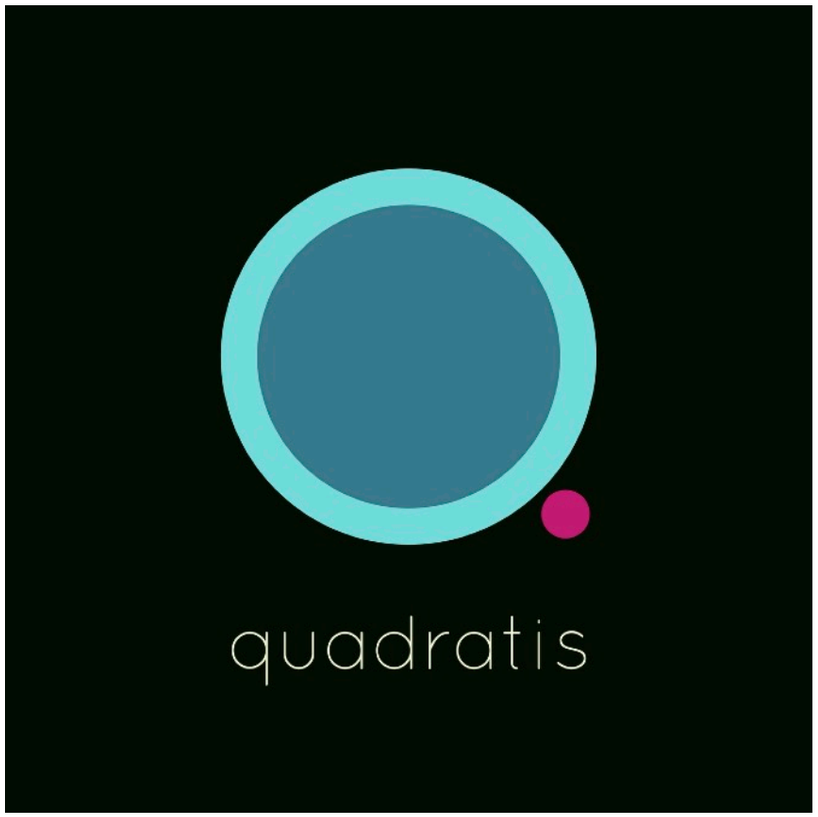
- time and expertise
- funding
- talented development team
- publicity and communication

Difficulties:

- finding time and expertise
- attracting funding
- getting talented development team
- developing a publicity and communication strategy

Post-Mathema:

- workshops
- what works best
- chromasquares + variations
- requests for more



The Quadratis© puzzles are based on ideas stemming from the math of combinations, shapes and space. They were created and brought to life by the "Quadratis" team:

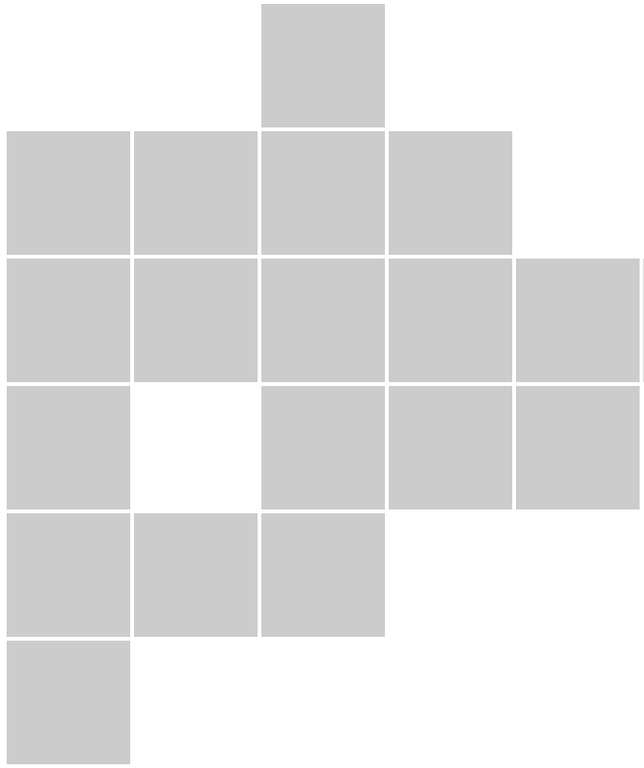
Hugo Parlier & Paul Turner
Math and design

Mario Gutiérrez & Reyna Juárez
Development

Quadratis Puzzles

Generalise chroma squares:

- board
- gluing of free edges
- standard gluing
- colouring



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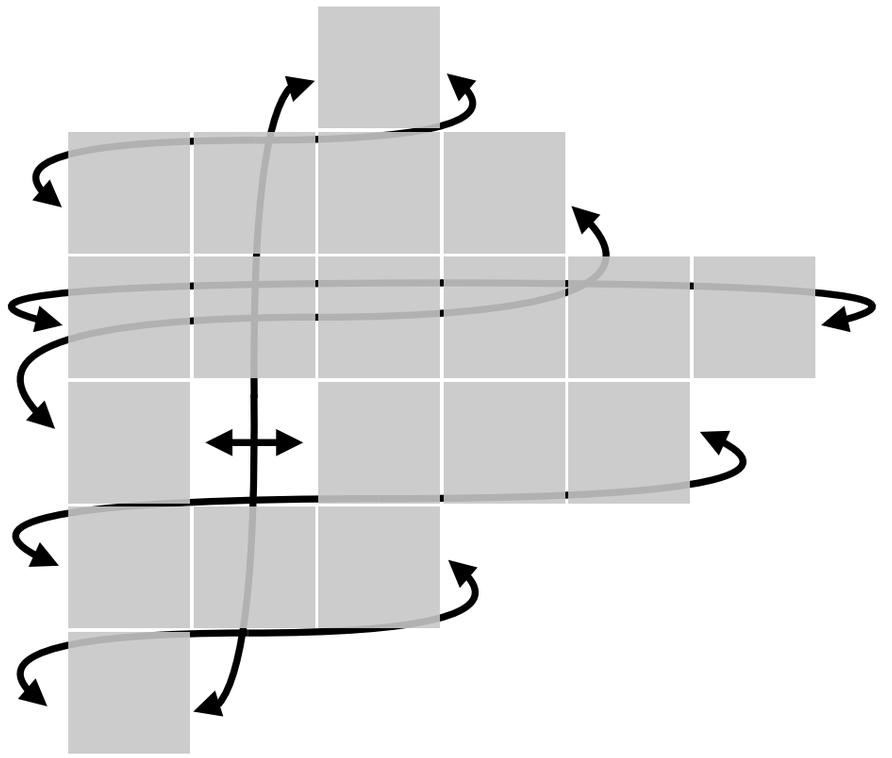

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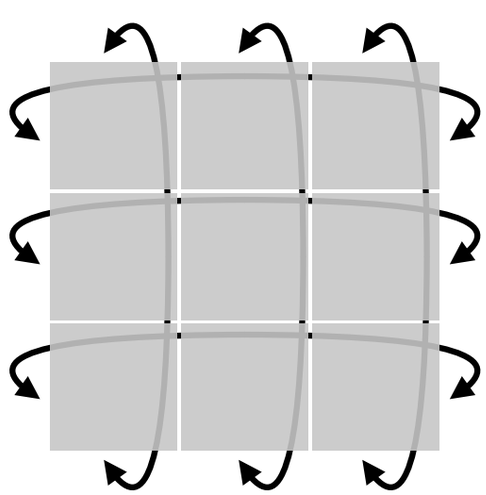

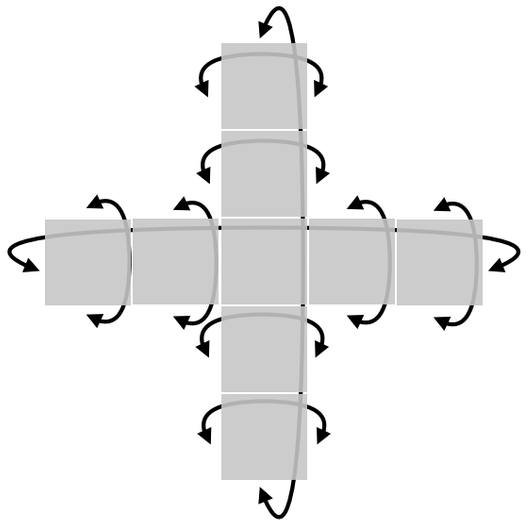

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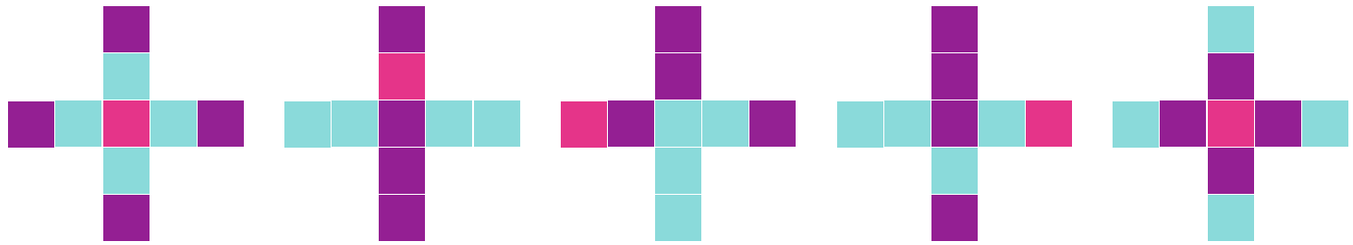
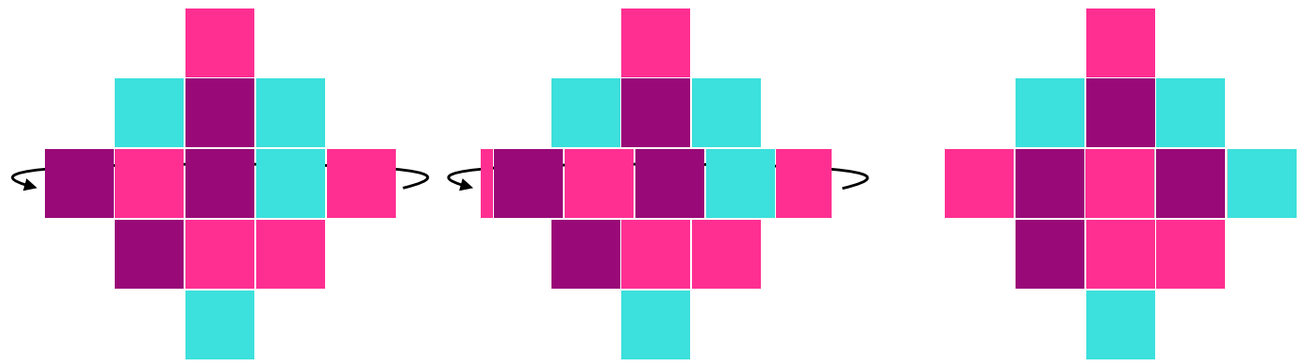
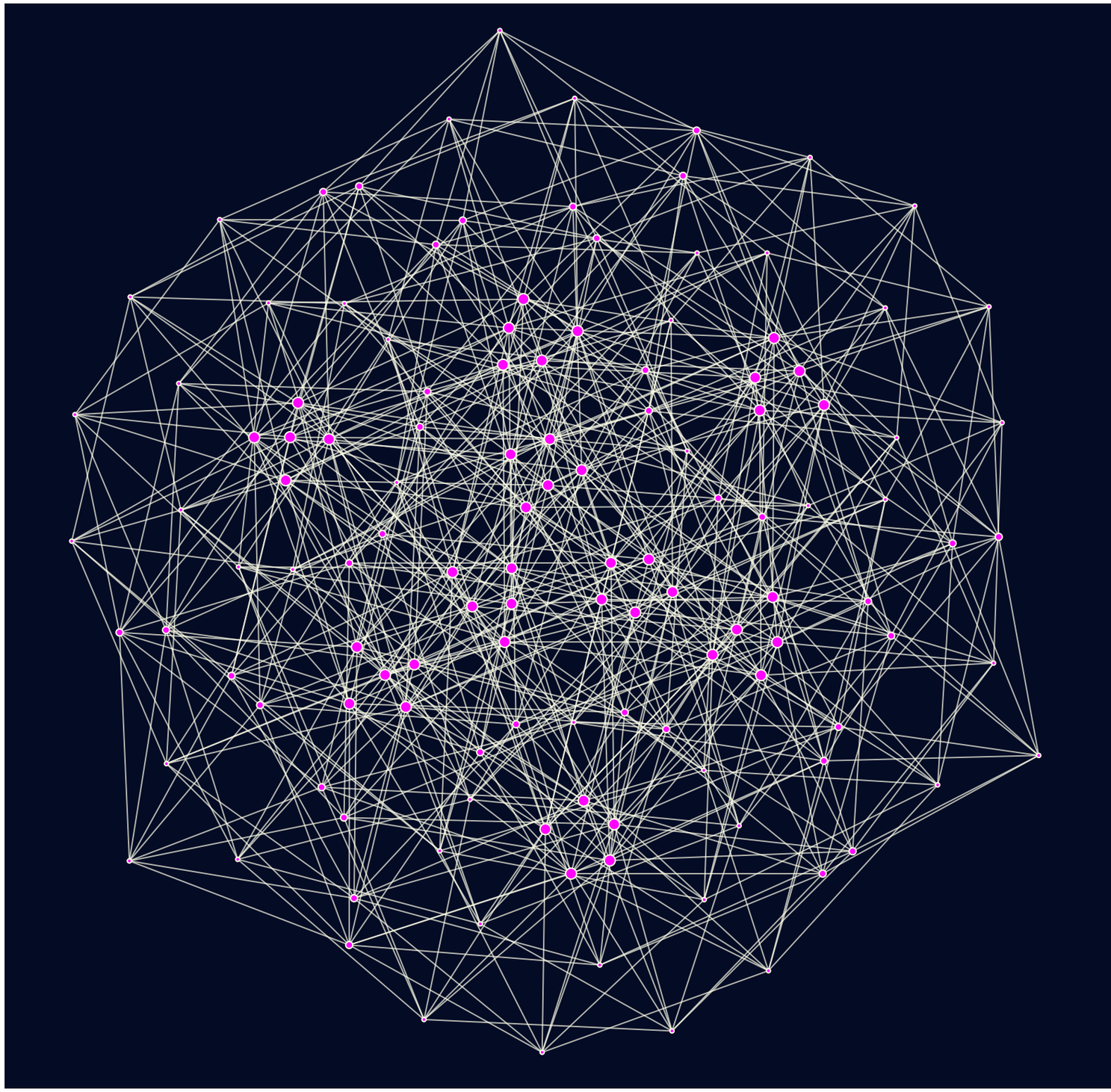


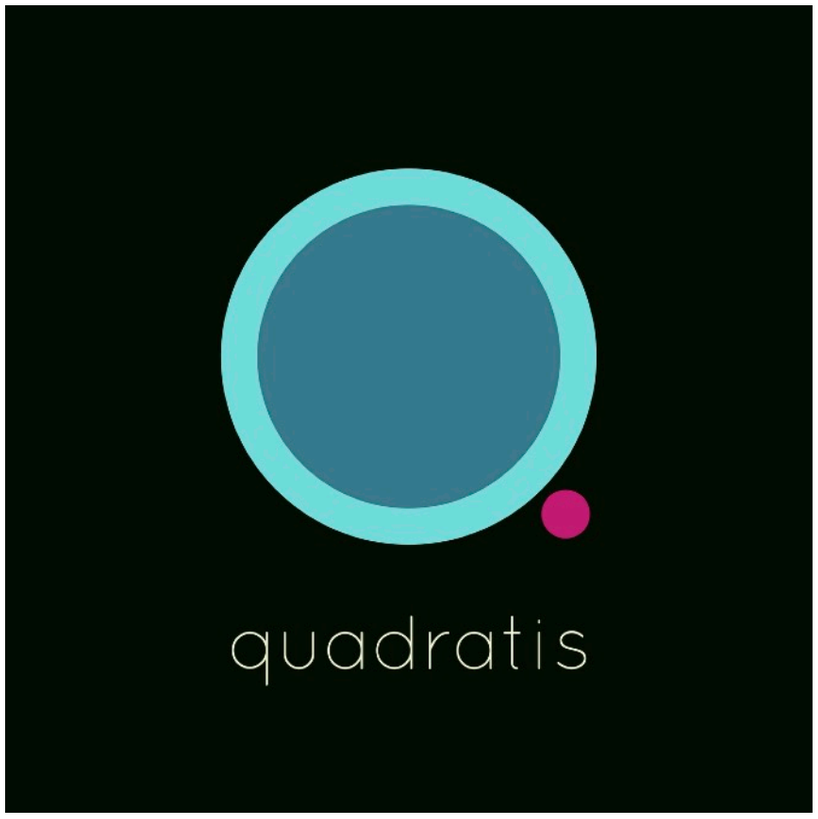
Dynamics:

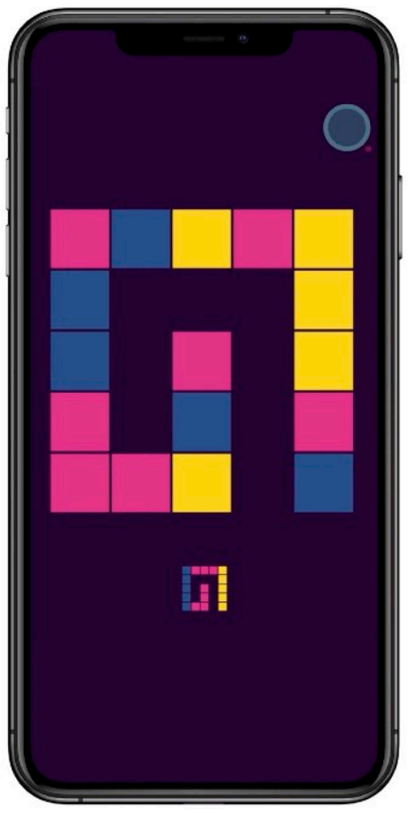
- as for chroma squares
- swipe up/down
- squares falling off the end following gluing instructions



The math: the *puzzle space* of a puzzle is a graph whose vertices are configurations and where two configurations are related by an edge if they can be related by a single move.




quadratis




Puzzle completed
Time: 0m 8.93s
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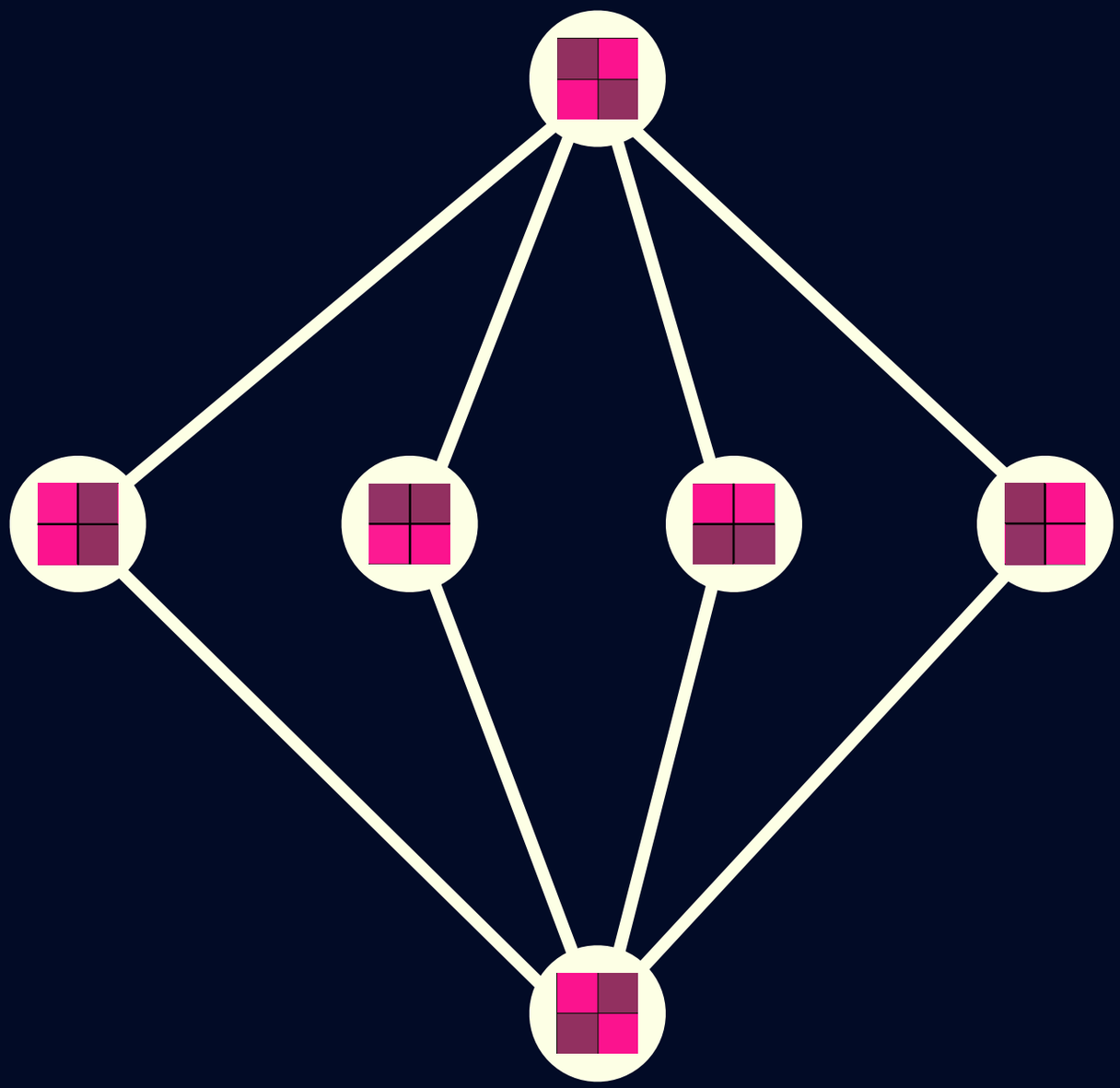
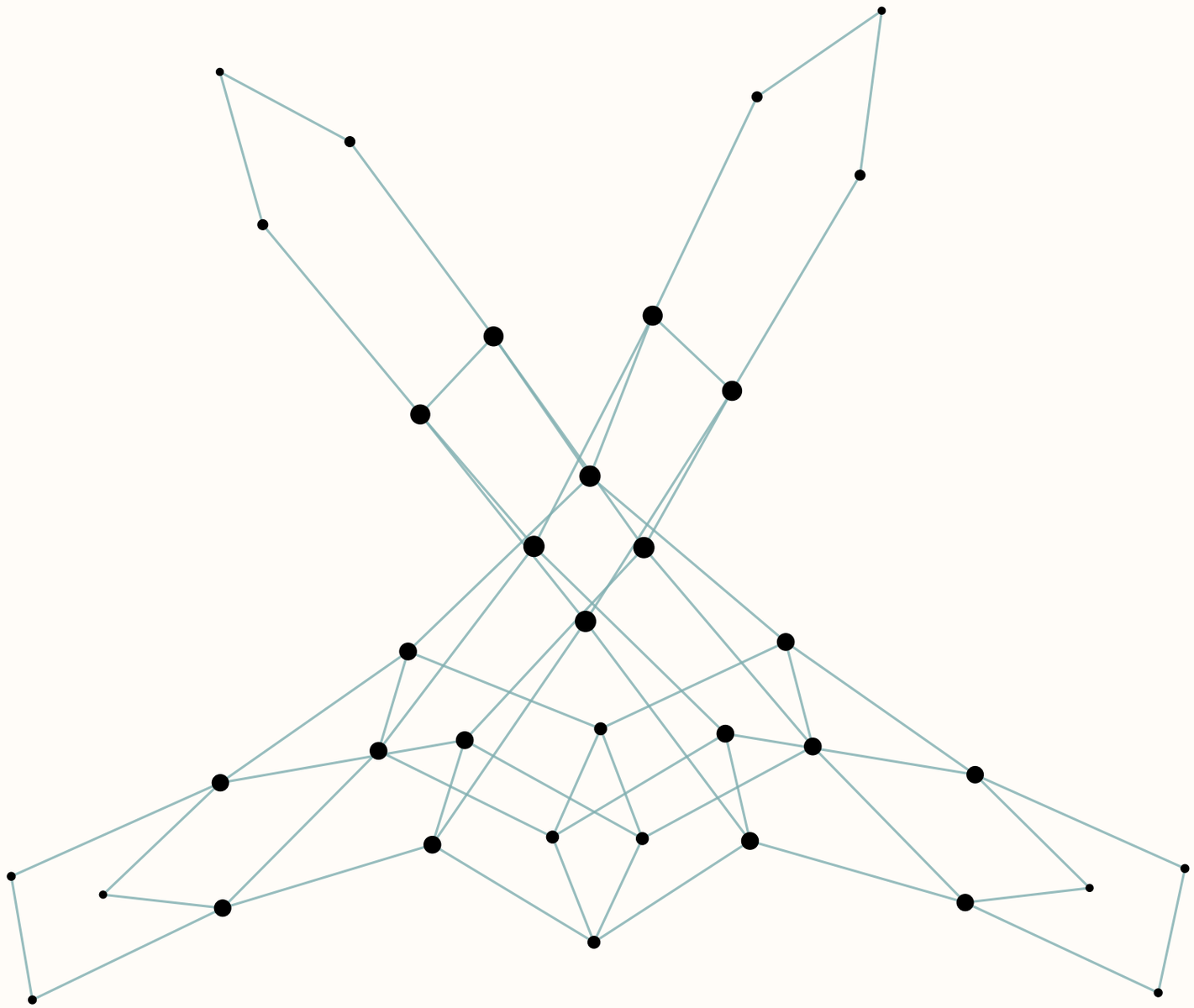
Score:

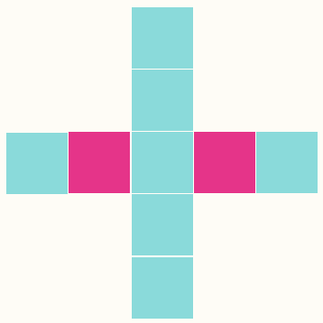
Researchers' Days,
2018, Belval

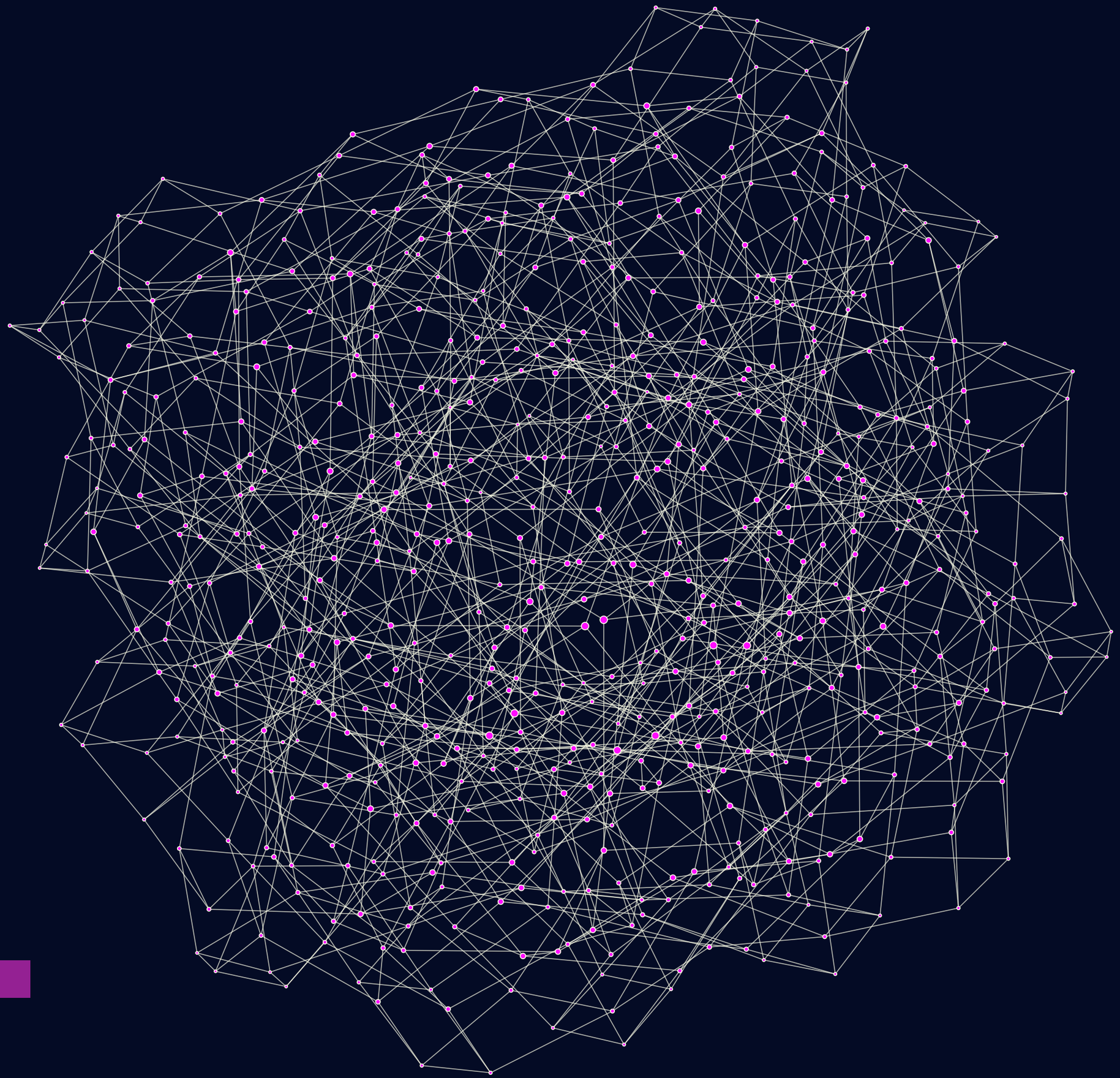
Puzzle graphs for square tiled translation surfaces

Created together with Paul Turner and brought to life with
Mario Gutiérrez and Reyna Juárez



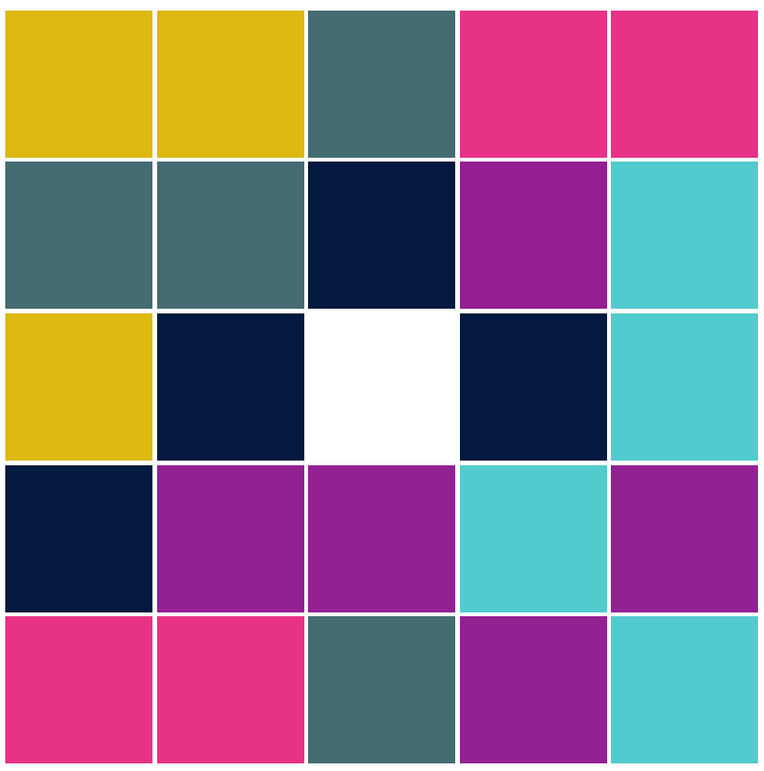






Quadratis graphs are big

Puzzle



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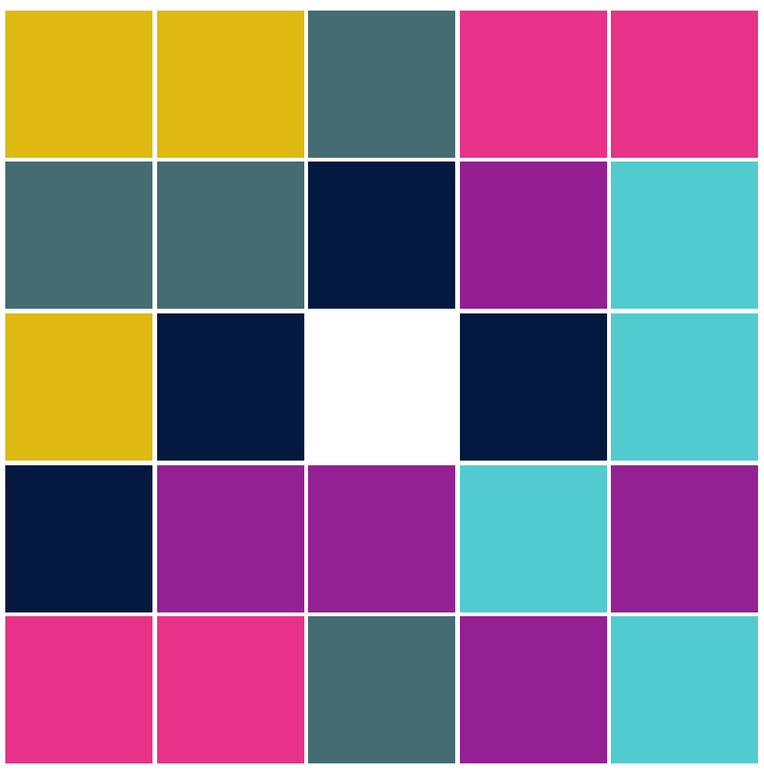
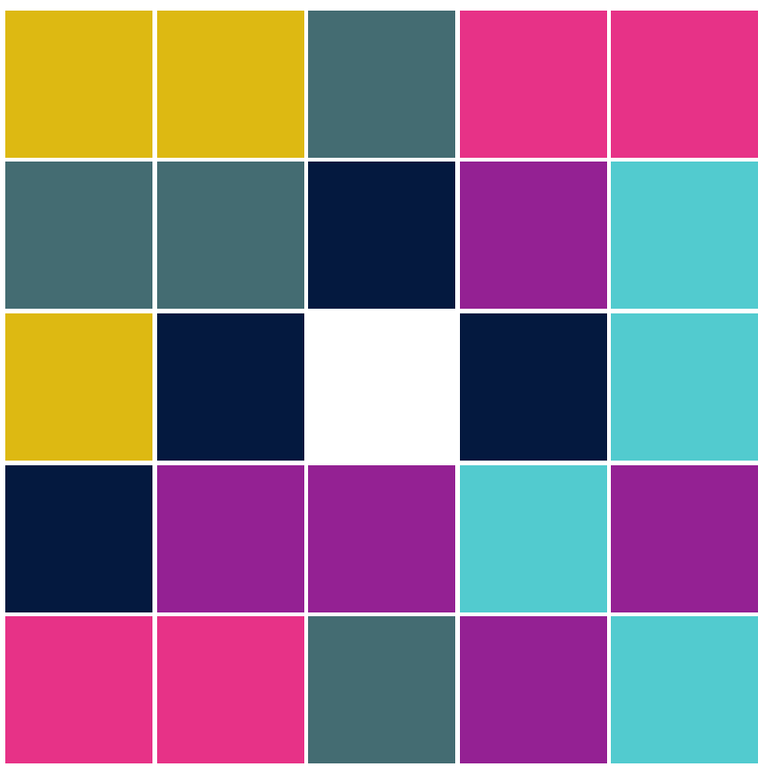


Size of the graph

3×10^{12}

Quadratis graphs are big

Puzzle

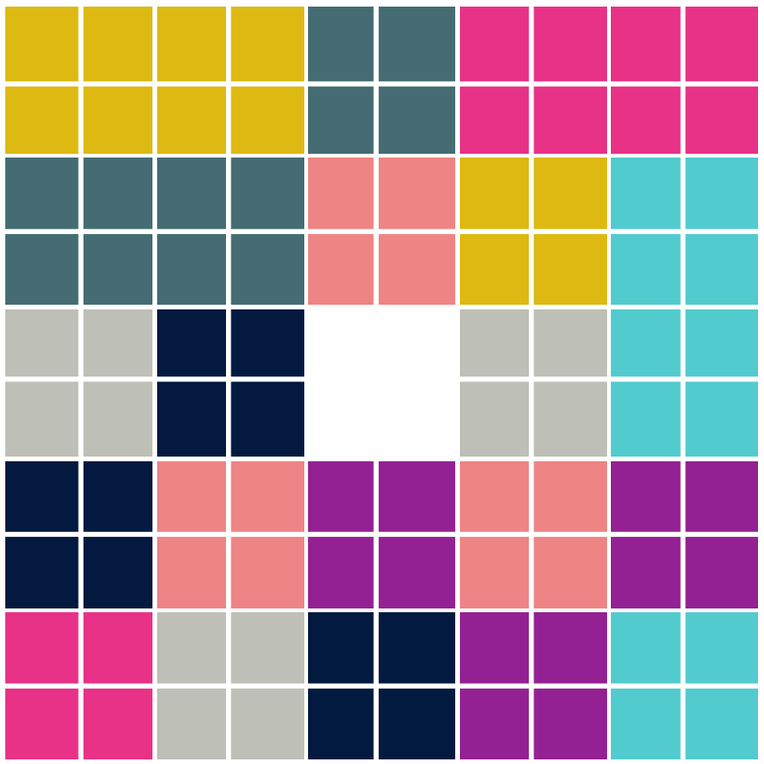


Size of the screen

Luxembourg

Quadratis graphs are big

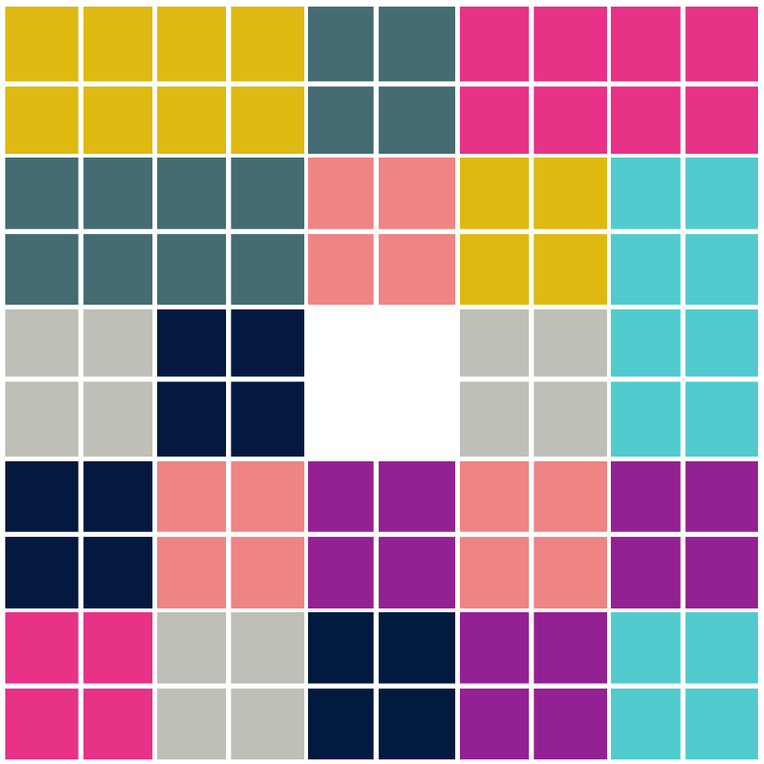
Puzzle



Size of the graph

Quadratis graphs are big

Puzzle

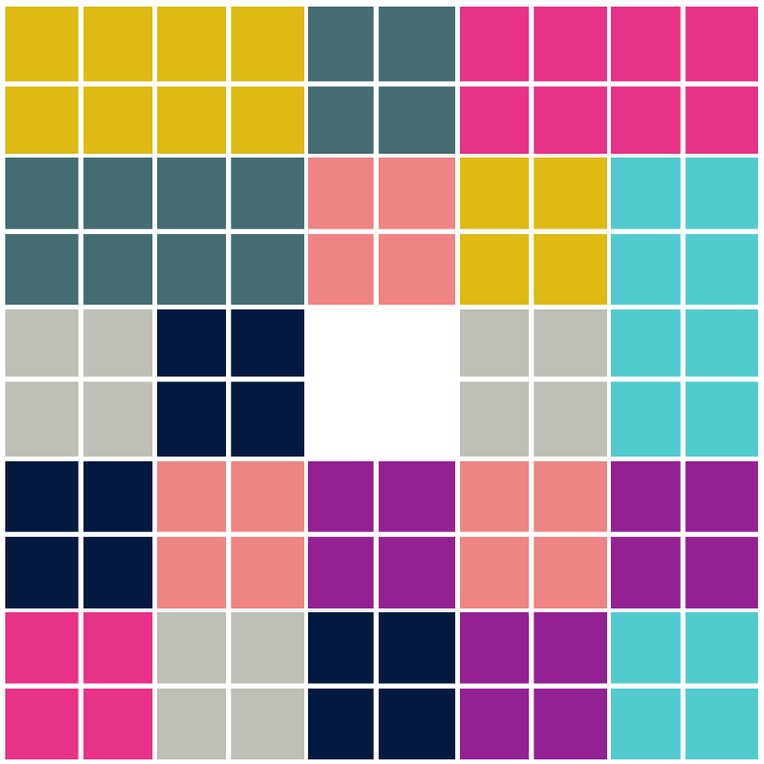


Size of the graph

4×10^{80}

Les espaces Quadratis sont grands

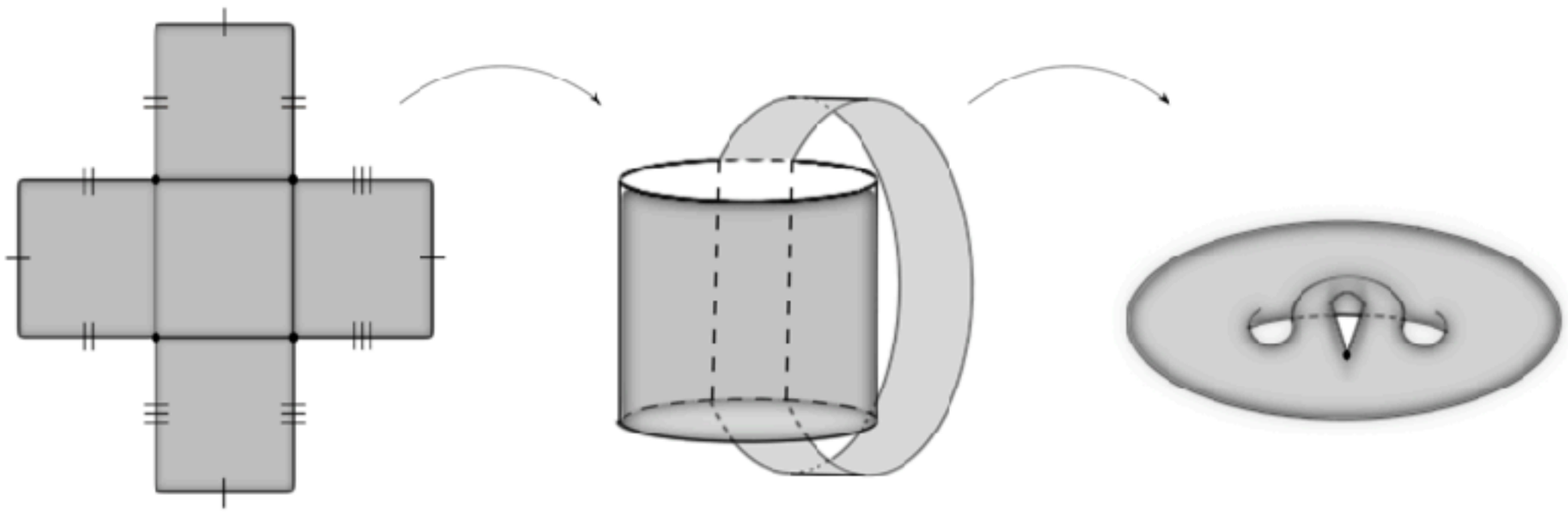
Puzzle



Size of the screen

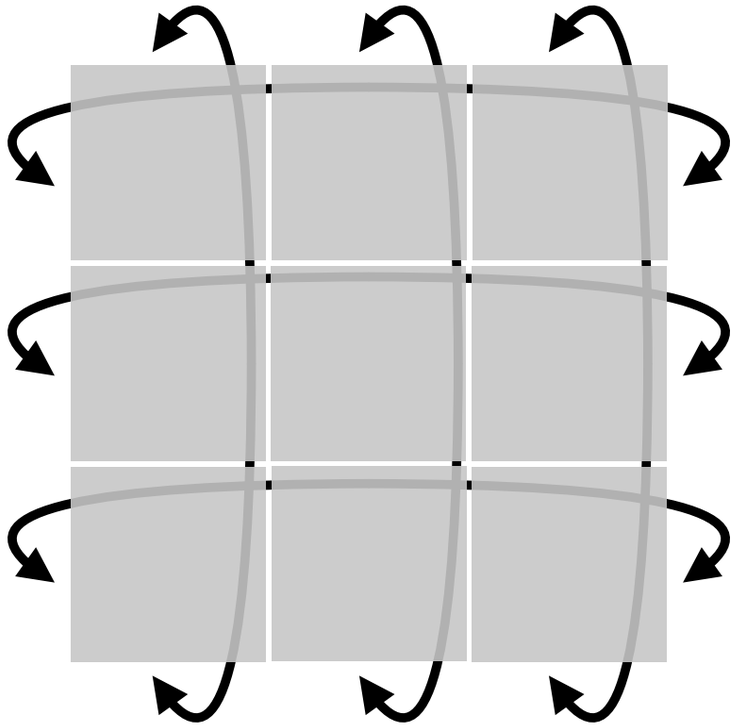
Bigger than Luxembourg.

Square-tiled translation surfaces

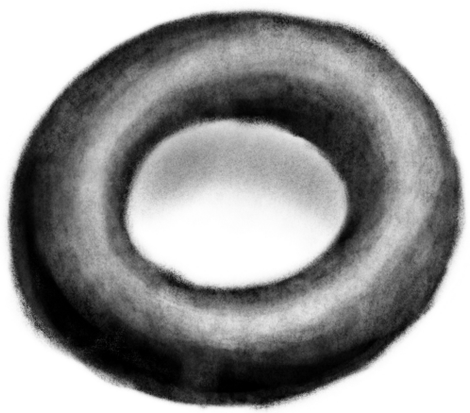


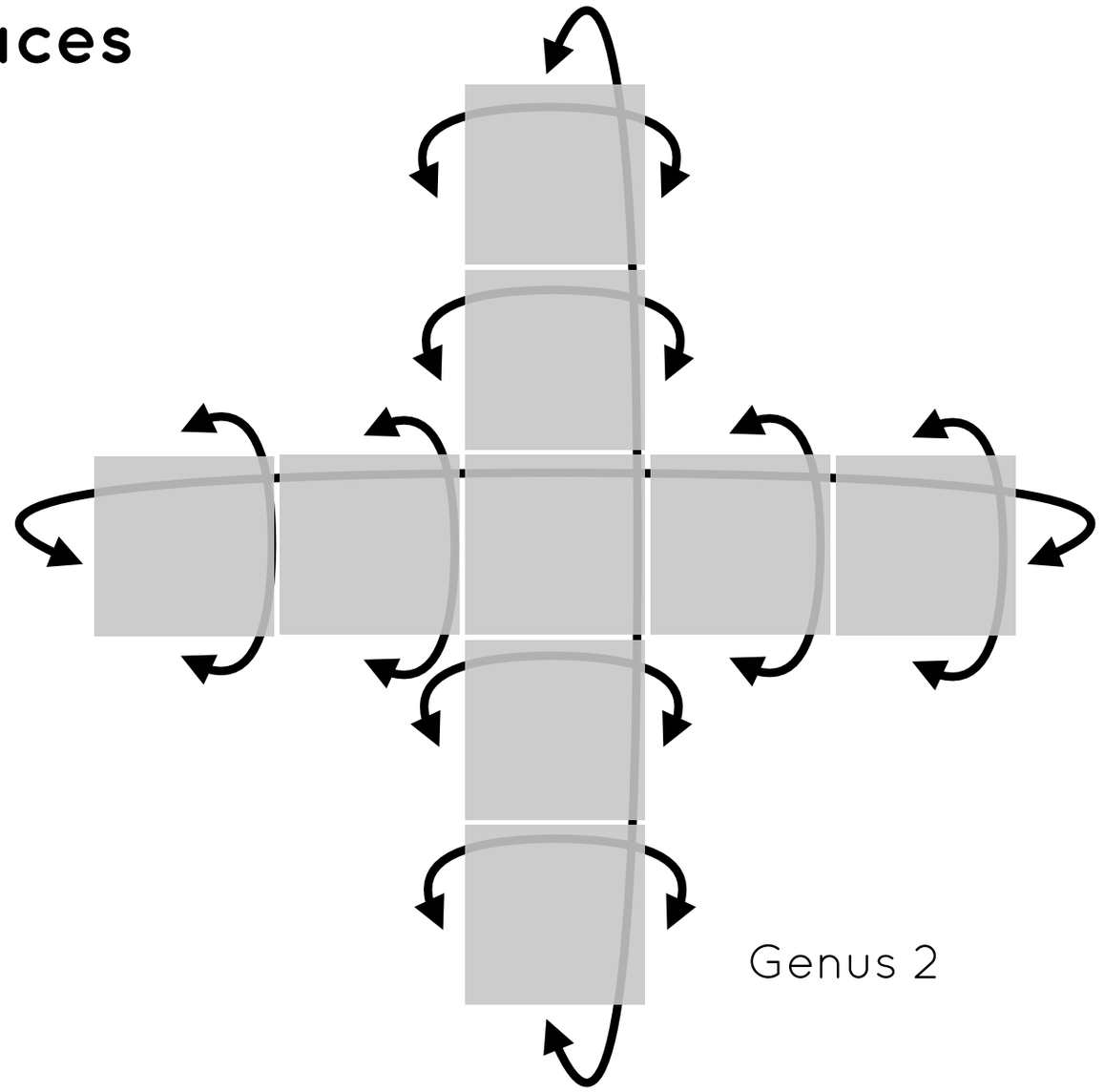
From C. Matheus' lecture notes

Square-tiled translation surfaces

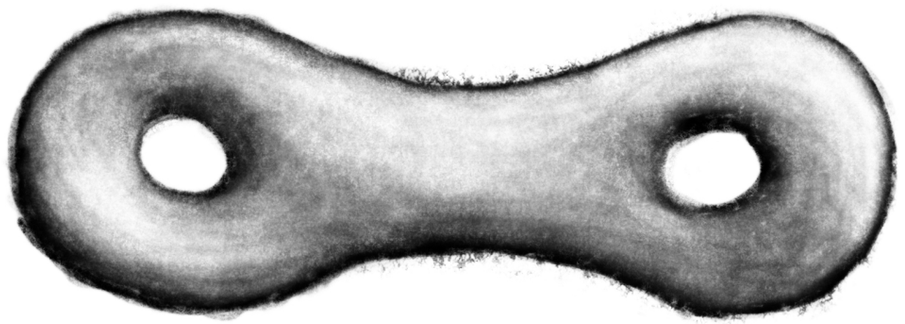


Torus = genus 1





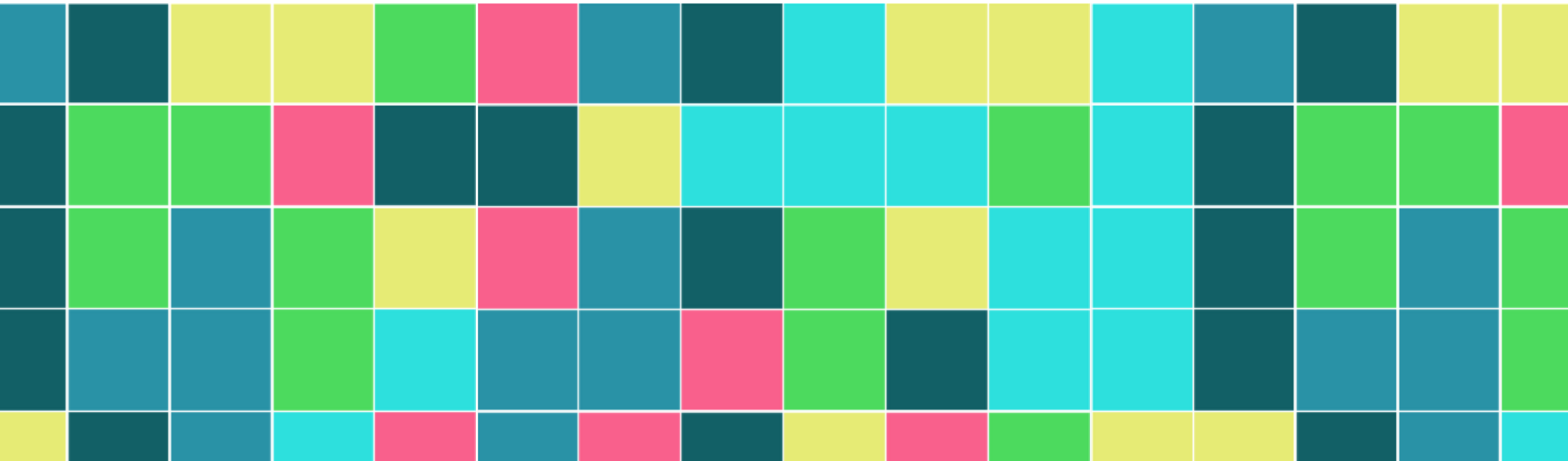
Genus 2



Things we could prove about arbitrary colorings of chroma-squares

If there are at least 2 square tiles of the same color or if n is even, then any two colorings can be joined by moves.

And this can be done in at most roughly n^2 moves for *any* coloring.

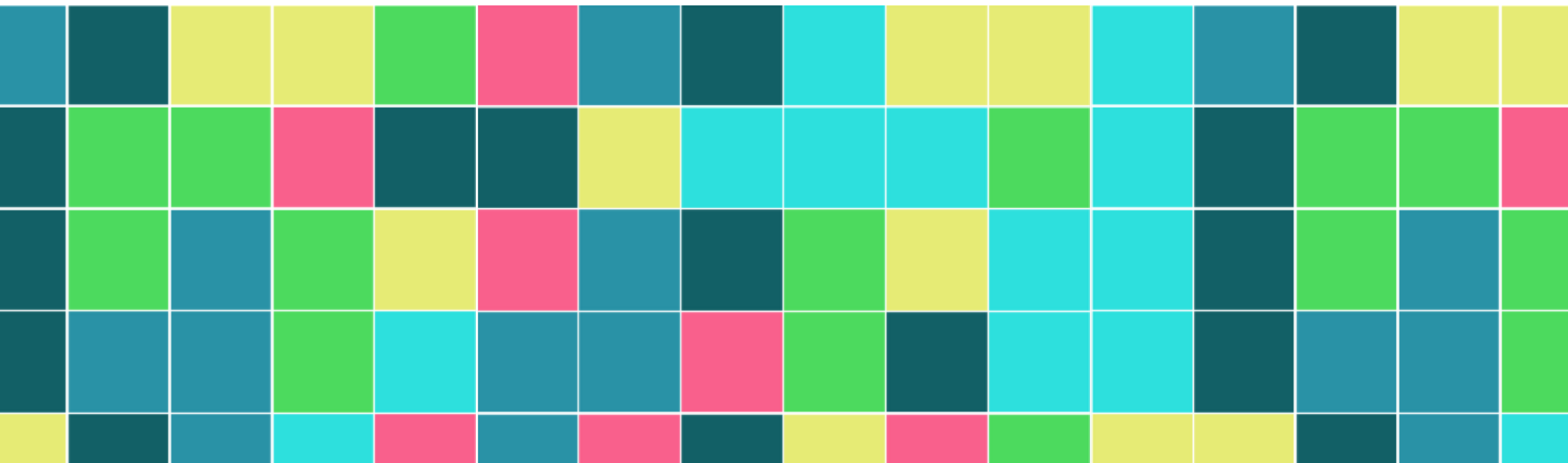


<u>But for arbitrary shapes:</u>

We don't have an algorithm to solve the puzzles.

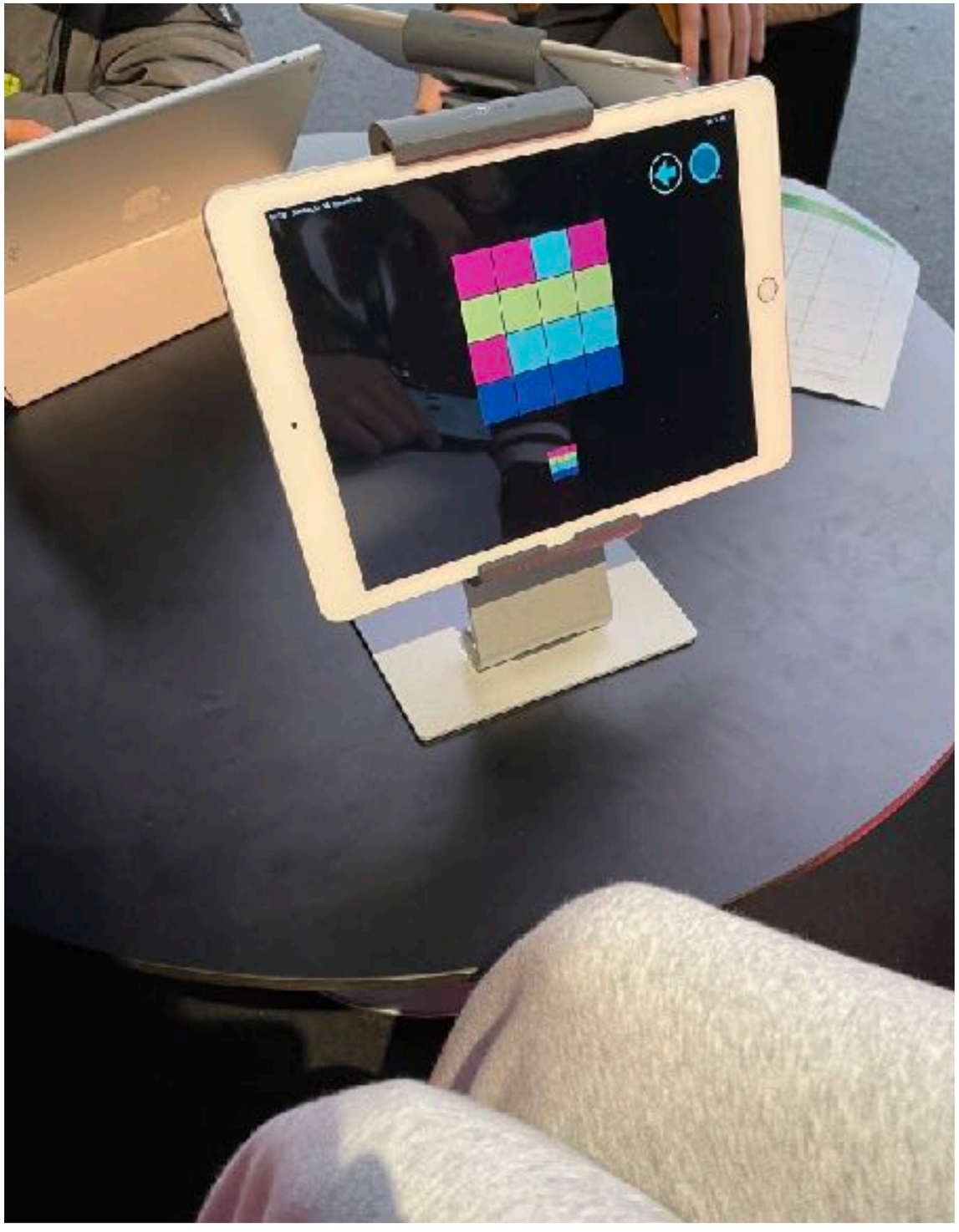
Questions about connectivity, distances, and counting puzzles are related to difficult problems on translation surfaces and moduli space theory.

Related to work of many authors, e.g., Eskin, Leli vre, Okounkov, Mirzakhani.



Crowdsourced research, Science Festival 2021

Crowdsourced research, Science Festival 2021



Inauguration of the Exploratis station in November 2021
Science Center, Differdange (Luxembourg)

Exploratis at the Expo

LUXEMBOURG PAVILION
EXPO 2020 DUBAI

The Simplicity of Complexity, World Expo 2021

Girls exploring math (GEM), May 12, 2022, Luxembourg

ReCreate, Expo Universelle, Dubai 2022

LUXEMBOURG PAVILION
EXPO 2020 DUBAI

Fonds National de la Recherche Luxembourg

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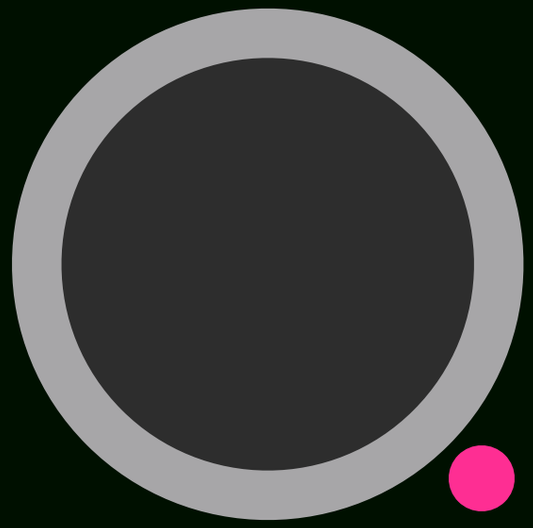
ReShape, Expo Dubai, 2022

reTrace

by quadratis



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