Zellij Multipuzzle

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Using the technique of laser cutting I recently made a game I named “zellij Multipuzzle”. It is a set of 669 zellij-style tiles. One side colored in white, the other in a different color, so each tile can be used in a “positive” or “negative” configuration, according to the necessary alternation of colors. There is also a set of units with which you can make frames of different sizes. This make the game easier for beginners.
This is the most efficient way I have experimented for an introduction to the art of geometrical arabesque : direct immersion in the galaxy of zellij !

1. Description of the game. The shape and the number of the tiles have been chosen to provide the largest possibilities of solutions in each situation (**fig. 2** is an example of two different solutions for the same beginning). Those solutions are standard motives that people are rediscovering, but they also can find original variations.
There is only one shape that does not have any symmetry axes (**Fig. 1**, left column of tiles, bottom), so it requires its chiral shape .
The frames are a help for beginners. They are made of different pieces, which allows different and fast configurations (beginning with a simple configuration, then removing parts of the frame to go to a more difficult level), and also makes the game easy to transport.

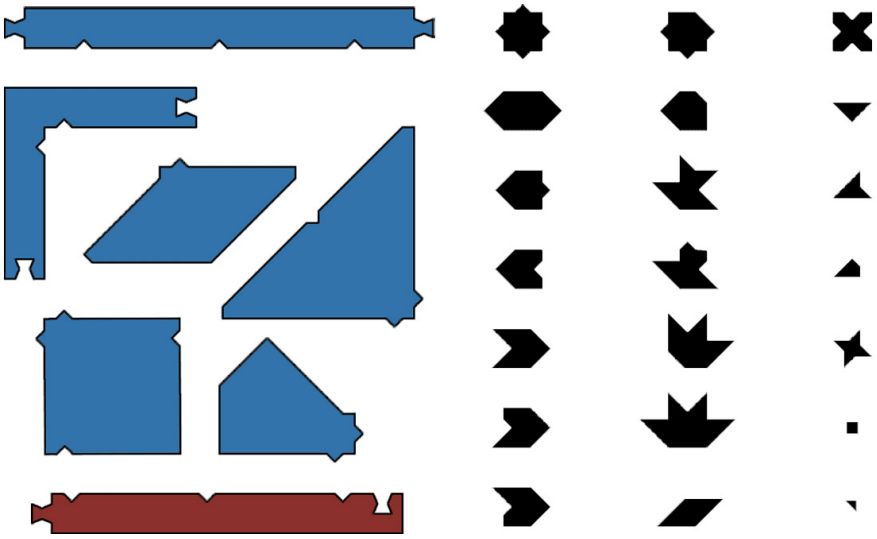

Figure1 : *Left : the different pieces of the frames. Right : the different shapes of the 669 tiles.*

2. Basic rules.

1. Alternation of the colors: adjacent tiles have to be of different colors (like a checkerboard). Two colors are available.
2. Continuity of the line: the line never stops running (except at the limit of the composition). That means that in each crossing you have an even number of lines. I say that the line have to keep alive, and everyone understands.
3. Recommendation 1: avoid having more than two lines crossing at the same point.
4. Recommendation 2: avoid having a line that changes of direction at a crossing.

An interesting way is to work according to the symmetries of the frame, and then break some of these symmetries.

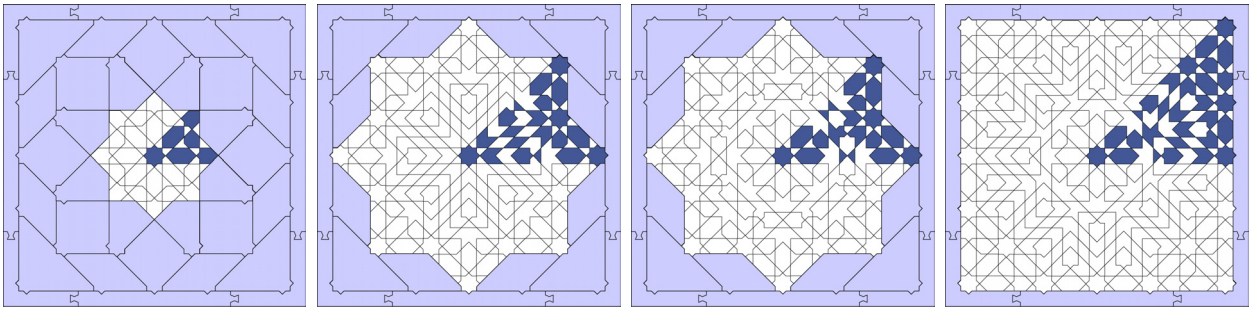

Figure 2: *Examples with different arrangements of the frames, or different solutions with the same frame.*

3. Previous experimentations (2005).

- Arabic World Institute (IMA), Paris. Public: high school students.
  The IMA uses the puzzle activity regularly (with different groups of people) as an introduction to geometric art.
- "La Cité des Sciences", Paris (Paris science museum). Public: mixed, adults and children.
- "Salon des Jeux et de la Culture Mathématique", Paris (a 4-days festival of mathematic games in Paris). Public: young people.
- International interdisciplinary conference "Science and Art", Athens. Public: adults.

In the first workshop I gave the participants some models to reproduce. But I realized that many people prefer to make their own models. Now I do not give models anymore. I explain with few words the very simple rules, and I let people the pleasure of (re)discovering patterns.

Figure 3 : *left and center: two patterns made by children without the use of models in a 45 minutes session. Sometimes you need a shape that is not available in the game, but you can often make it assembling small ones: this is the "tangram aspect" of the game. In the second example (with the small frame) they first found a symmetric solution, then I encouraged them to break some symmetries. Right: an example made without frames, with an octagonal limit, and no axes of symmetries but a center of rotational symmetry.*