# Mirror Symmetry Collages in Folded Paper

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## Abstract

The paper will explain a folding technique using 2-, 4- and 8-fold mirror symmetry, not using one sheet, but using multiple sheets of folded paper, arranged as a collage. It will show how this manifestation of mirror symmetry can be used to create the illusion of squares or rectangles that appear to overlap and dissolve, often in visually pleasing and unfathomable ways. The results are atypical of geometric origami, creating a visual language that is perhaps closer to fine art than to the decorative arts, with which origami tessellations and corrugations are often associated.

## Background

The occurrence of mirror symmetry in origami is so common as to be practically ubiquitous. Almost any model, whether flora, fauna or geometric, will have examples of mirror symmetry in its final form. Further, when unfolded, a crease pattern, however simple, will show many more examples.
At its simplest, any new fold that terminates at an existing fold, will create at least one example of mirror symmetry, which can be seen when the paper is completely unfolded (see Figure1).

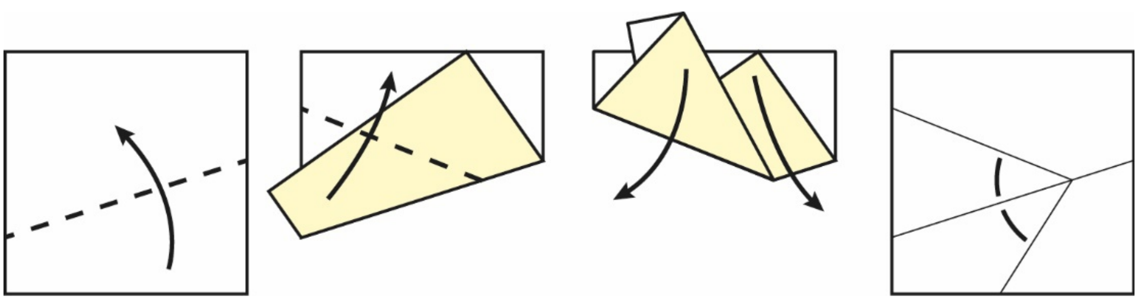


***Figure 1.*** *A fold is made randomly on a square of paper, then a random fold is made through all the layers, terminating at the first fold. When the paper is completely unfolded, the first fold can be seen to have created a line of mirror symmetry between the creases of the second fold.*

The classification of how examples of mirror symmetry can be created by folding paper is not discussed here. Instead, this paper will discuss how mirror symmetry can be created when *separately-folded* sheets of paper are juxtaposed as a collage. To the writer's knowledge, it has not been discussed in print before.

### *Two-sheet Example*

This is the simplest example of creating mirror symmetry by juxtaposing separately folded sheets of paper. In this instance, one random fold is made in the same place on two identical sheets of paper. By refolding, turning over and rotating one of the sheets in relation to the other, the curious illusion is created of two squares of paper which appear to interpenetrate each other, on the same plane (see Figure 2). This illusion will be created when making identically placed single folds on two identical sheets of *any* shape.

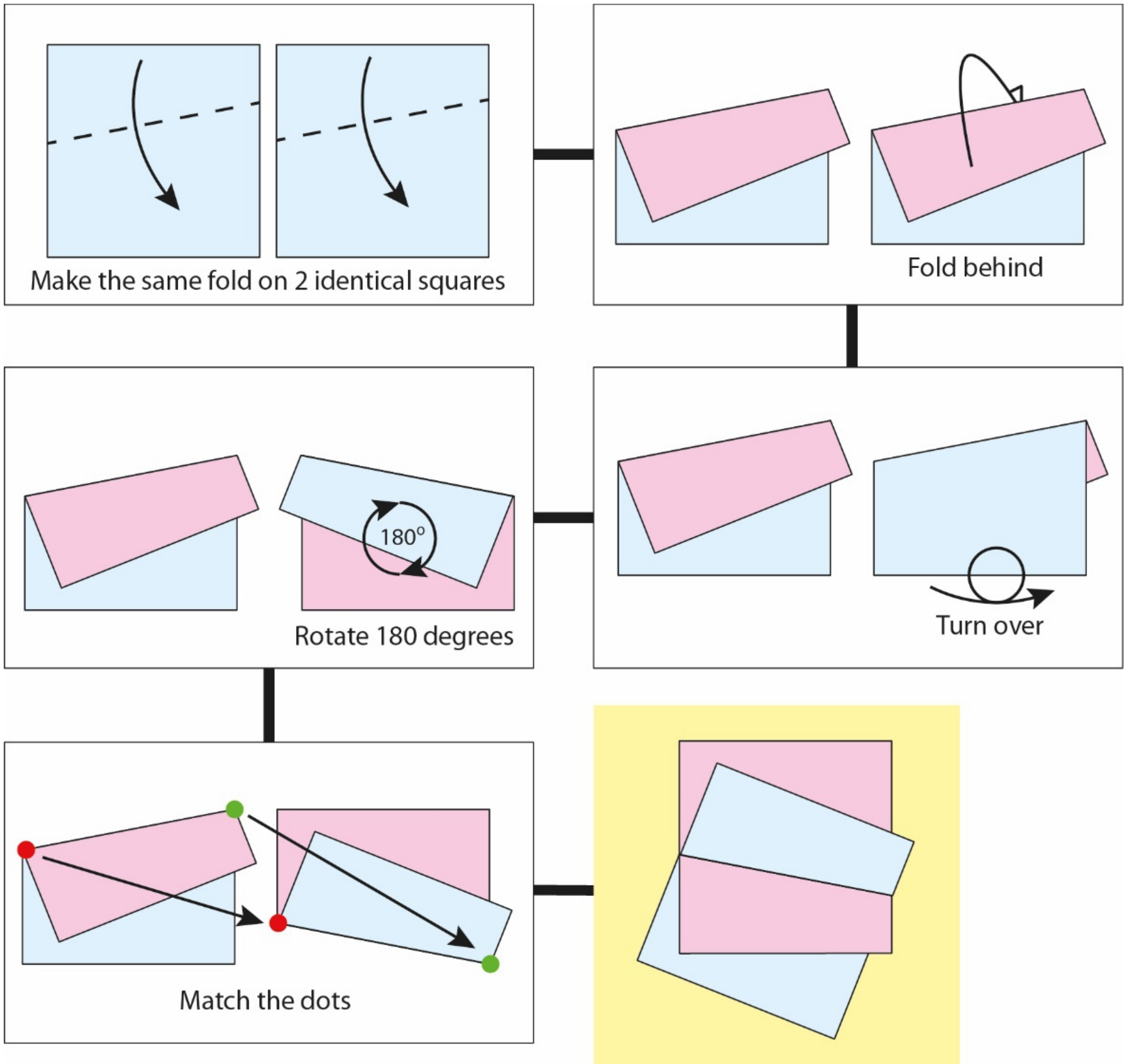



***Figure 2.*** *Note how the final composition of the two squares has a line of mirror symmetry along the edge where the two folds butt against each other. Each sheet is the mirror image of the other. Note also how the two sheets have opposite colouration and the size of each composite square is the same size as the original sheets of paper.*

***Four-sheet Example***

The two-sheet example above creates mirror symmetry across a central line. Thus, a full rotation of 360-degrees is divided into two segments of 180-degrees. To explore the theme further, each of the 180-degree segments can be divided in half, to create four segments of 90-degrees with four-fold symmetry. This can be achieved by making the single fold in Figure 1 and adding a second fold, perpendicular to the first (see Figure 3, below).

In addition to four-fold symmetry around a central point, it is also possible to create six-fold and eight-fold symmetry collages, with six or eight interpenetrating squares.

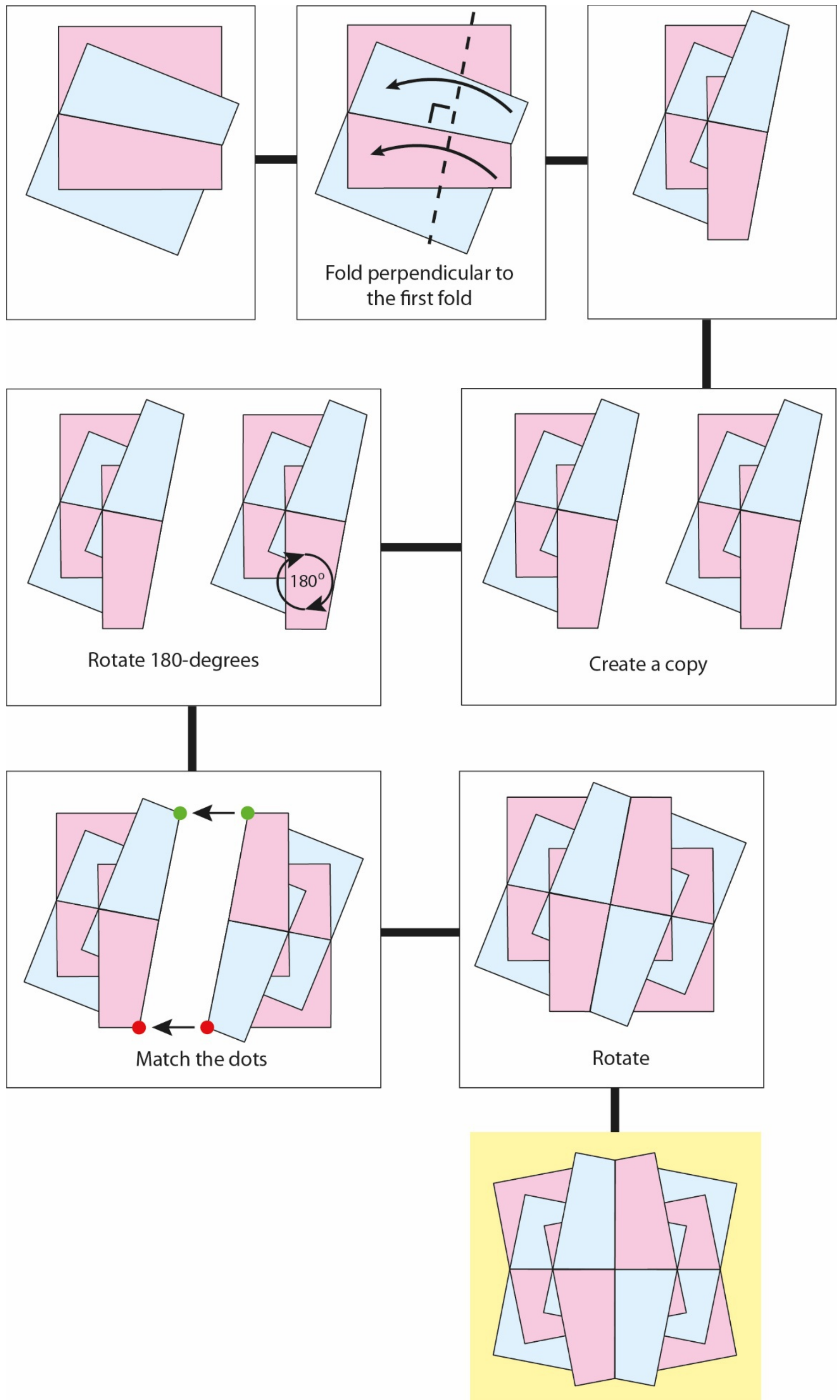



***Figure 3***. *We can see the illusion of four interpenetrating squares, two pink and two blue. Note that sections of each square are split into each of the four quarters of the collage.*

***Non-rotational Interpenetrating Effects***

Figures 2 and 3 above show how the illusion of interpenetrating squares can be applied to rotational symmetry. However, it is also possible to create the effect without rotational symmetry. These in-line effects permit the geometric constraints of rotational symmetry to be cast aside, so that collages become improvised and open-ended. It is perhaps at this point that we cross from what may be termed a *'curiosity of folded geometry, made visible'*, to an *artwork*.

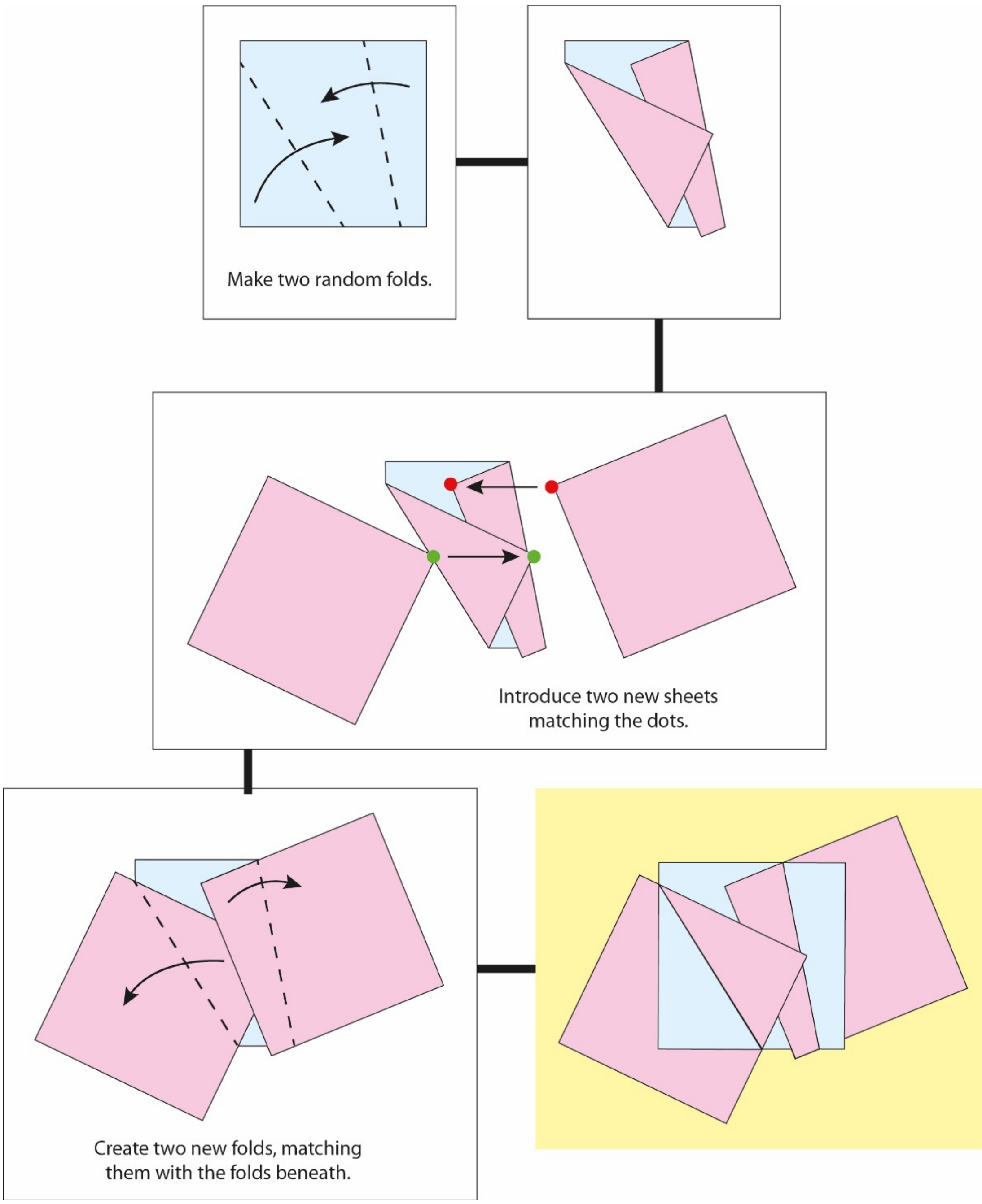



***Figure 4.*** *This method to create a linear collage of interpenetrating squares, may be continued indefinitely. Sheets of other shapes and sizes may be introduced.*

## Conclusion

This simple application of mirror symmetry to folded paper offers many creative possibilities. The mathematics is intuitive, allowing us to focus on visualising forms, not visualising formulas. Further, the folding of flat planes dissects a polygon into smaller polygons, which may be stacked and made from stiff, unfoldable materials. Thus, this is not primarily a paper folding technique, but one which may find expression in a diversity of sculptural and permanent materials.

## Gallery

All works are by the writer, 2013-2020.

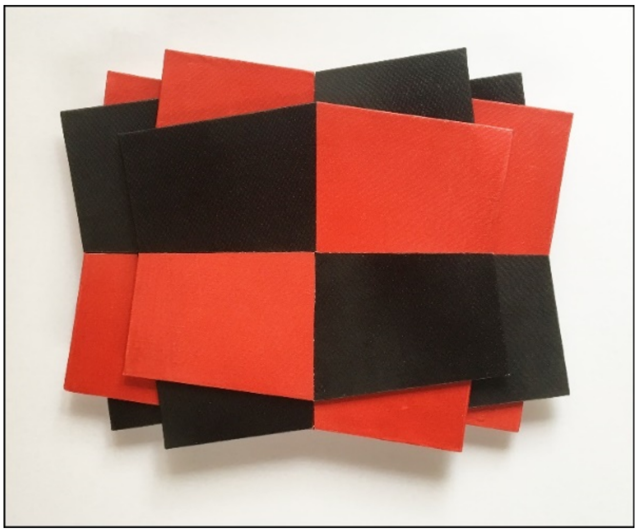


***Figure 5***. *Cut canvas board and paint. 40 x 29 x 2cm*

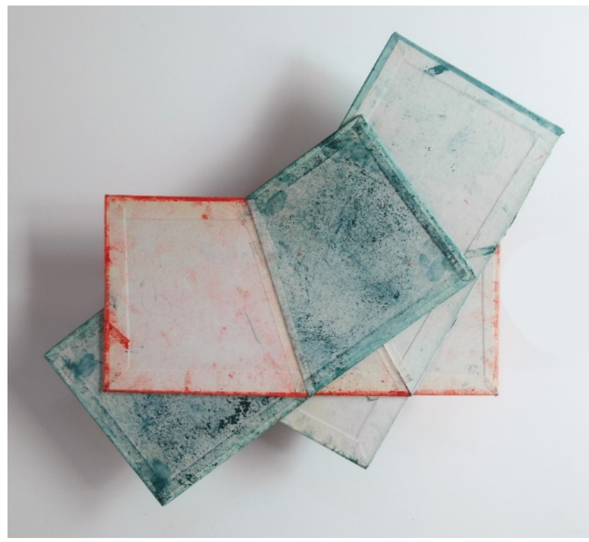


***Figure 6***. *Cut canvas board and paint. 48x2x2cm*

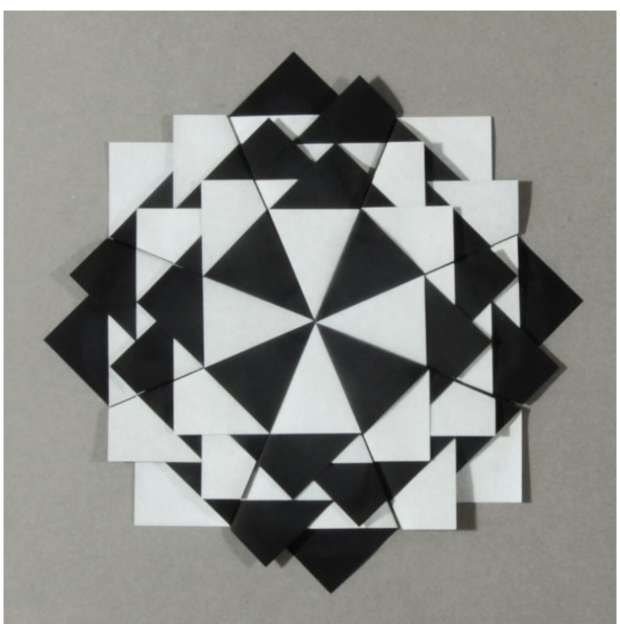


***Figure 7***. *Origami paper (8-fold symmetry). 25x25cm*

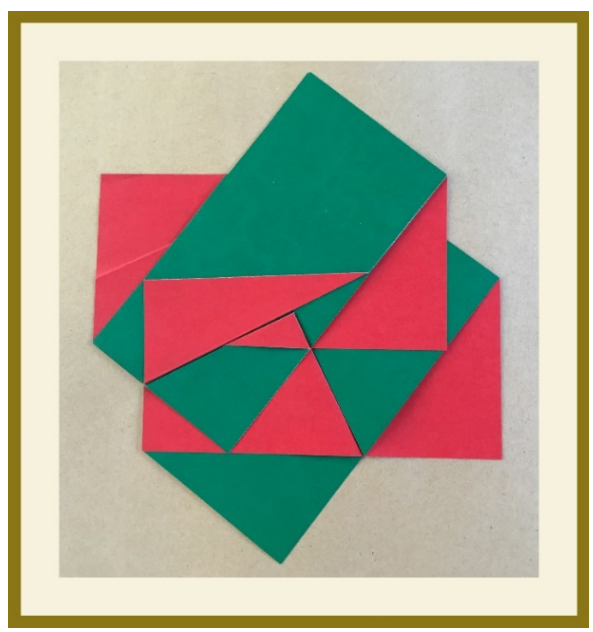
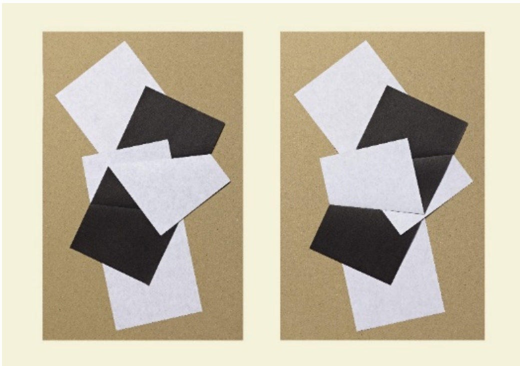


***Figure 8***. *Origami paper. 25x25cm*



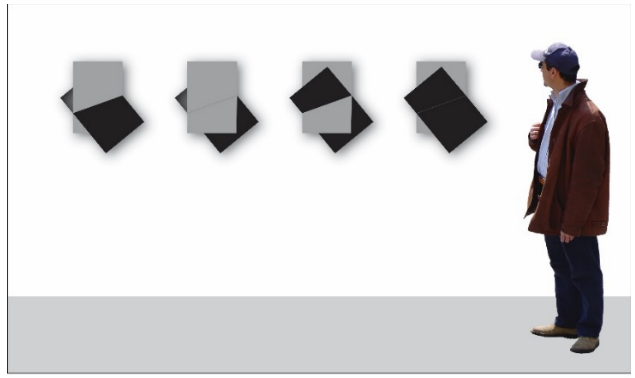


***Figure 9***. *Origami paper. 50x39cm*

***Figure 10***. *Gallery view. Cut canvas board and paint. 220x40x4cm*

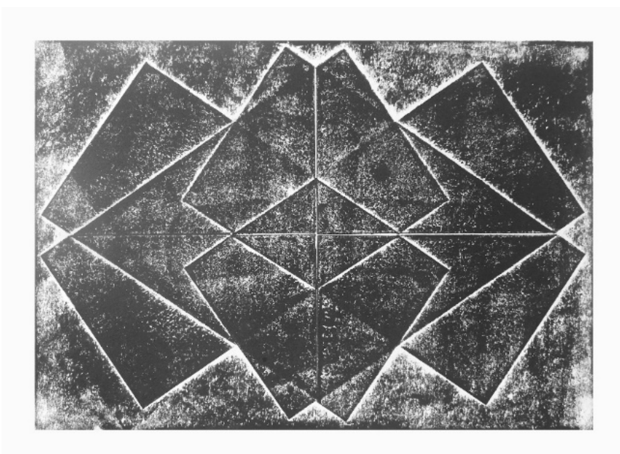


***Figure 11***. *Monoprint. 30 x 22cm*

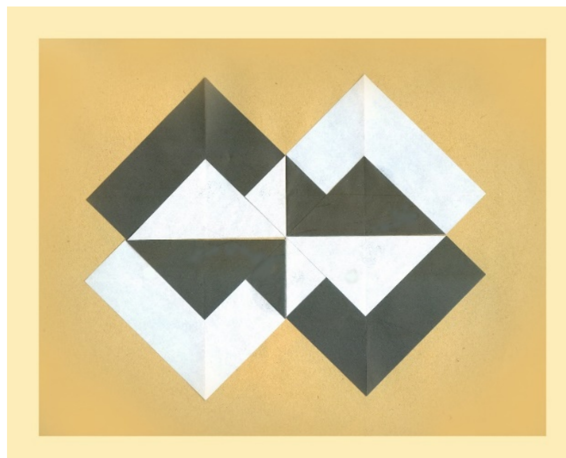


***Figure 12***. *Origami paper. 18 x 15cm*

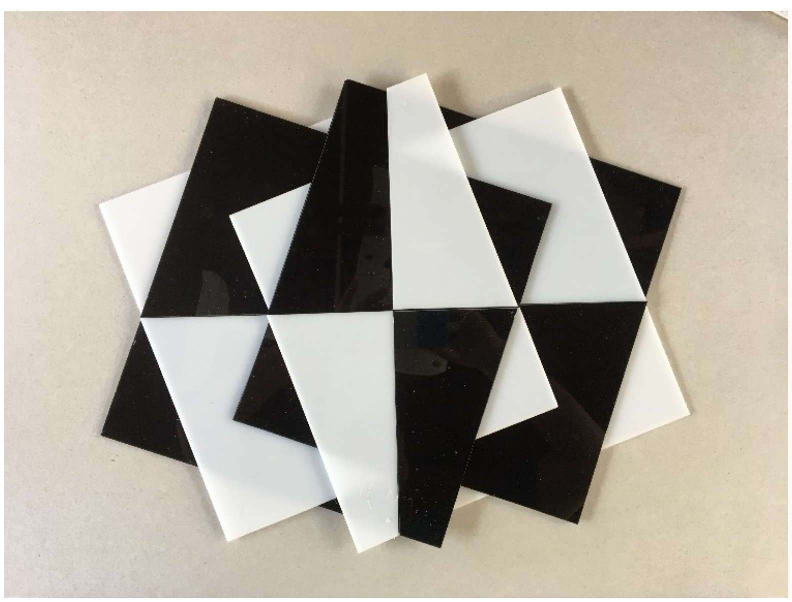


***Figure 13***. *Perspex. 55 x 40 x 2cm*