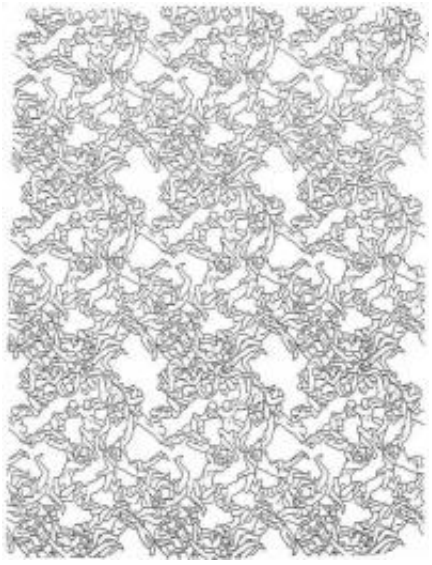
Exploring tessellations beyond Escher

June 16 2011, by Lisa Zyga

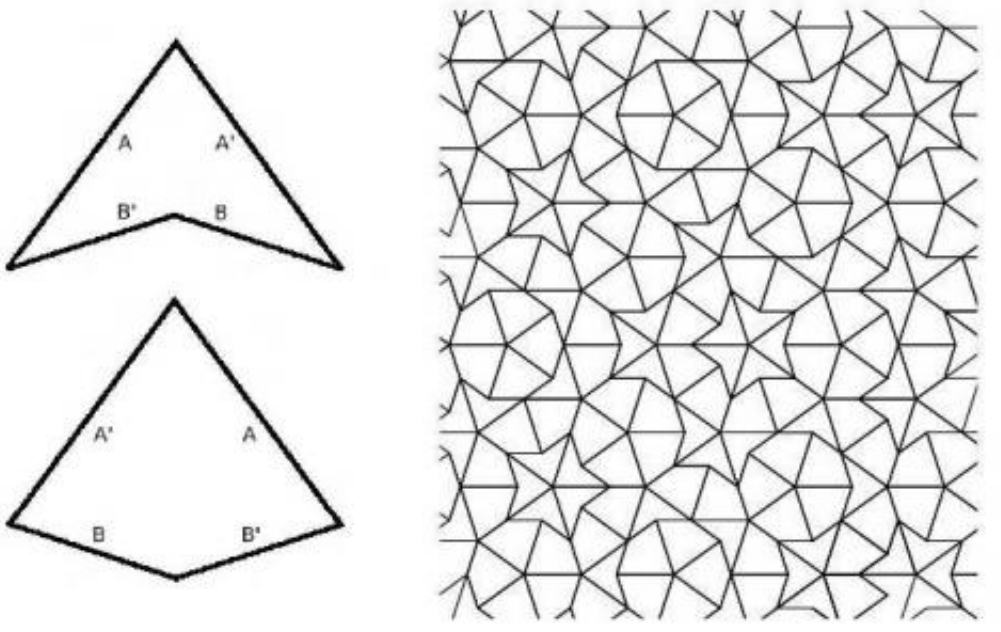


A tessellation pattern created by San Le, building on the work of M. C. Escher. Image credit: San Le.

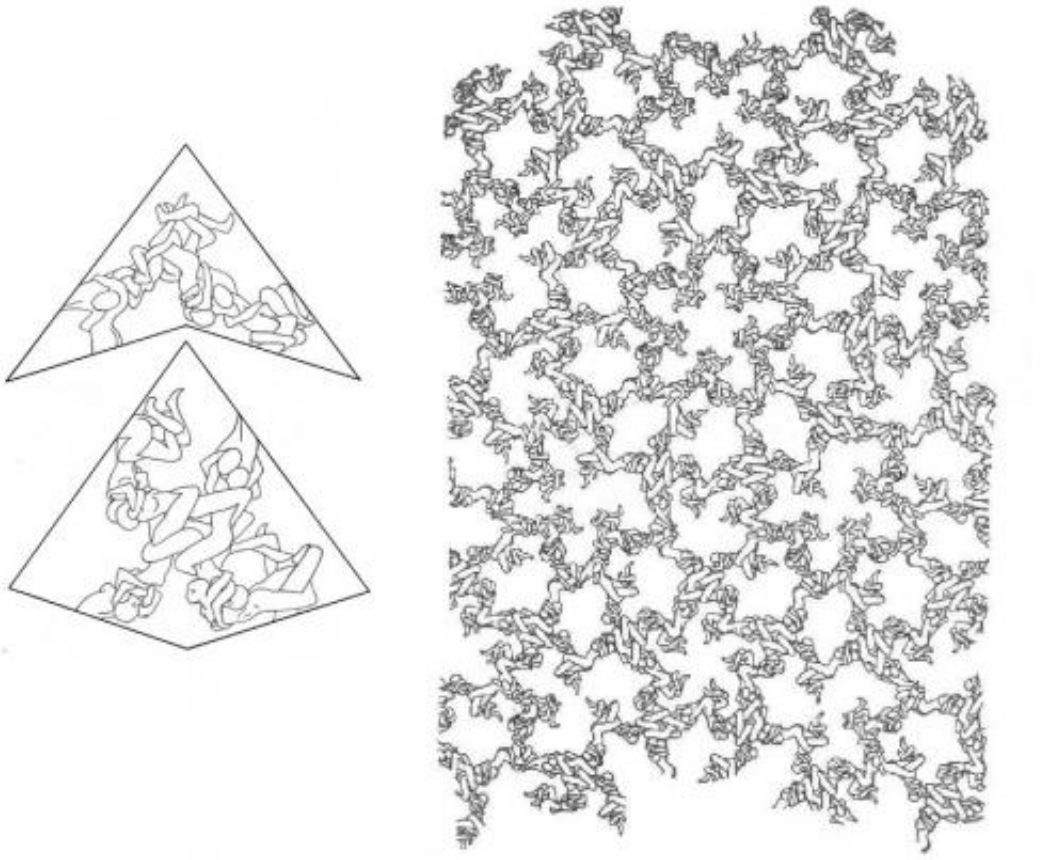
(PhysOrg.com) -- By incorporating geometrical concepts into his artwork, M. C. Escher demonstrated the potential beauty that could be achieved by combining mathematics and art. One of Escher's most well-known types of art is tessellations, in which he combined tiles with images of lizards, fish, angels, and other figures to create various repeating patterns. Recently, computer programmer and artist San Le from Santee, California, has shown how to generalize Escher's technique, revealing that many mathematical shapes are still waiting to be explored.

"Escher's work introduced the world to the beauty of geometrical art," Le writes in a paper at arXiv.org. "But non-mathematician artists tended not to follow his example, and so a wealth of trigonometric shapes only exists as blank tiles waiting to be filled. By describing the process of incorporating tessellations and fractals into art, we hope to show that the challenges are artistic rather than mathematical."

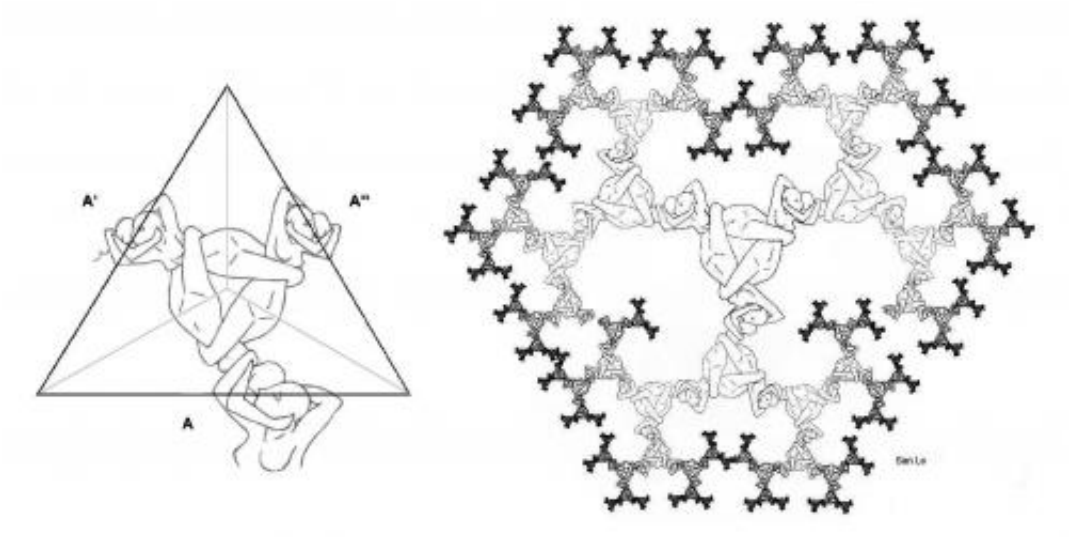
Whereas Escher's tessellations and that of most artists that came after him have consisted of tile images having one dominant figure in a tile that is completely filled, Le deviates from this standard by experimenting with multiple figures and negative (white) space between the figures. This change allows for different ways to connect the tiles, such as with Penrose tilings, fractals, and tessellations inside fractals. Some example are shown below.



The two Penrose tilings on the left, which consist of a dart and a kite shape, are connected by following simple rules (e.g., A with A, A' with A', etc.). These tilings create the tessellation pattern on the right. Image credit: San Le.



The two Penrose tilings on the left contain a design of intertwined human figures with negative space in between. Using the same connecting rules as above, the tiles create the tessellation pattern on the right. Image credit: San Le.



The fractal-tessellation combination tile on the left was used to create the pattern on the right. The tiles were decreased in size by one-third instead of one-half to prevent branches colliding. Image credit: San Le.

As Le writes in his paper, there are limitless possibilities for what designs can be drawn inside a tile. By exploring new designs, along with new shapes and new ways to connect tiles, there are many interesting patterns that are still waiting to be discovered.

More information: San Le. "The Art of Space Filling in Penrose Tilings and Fractals." arXiv:1106.2750v1 [math.HO]

via: The Physics arXiv Blog