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Everyday Science

USE OF MATHEMATICS IN ART

Literature Review

Mathematics has been regarded as art with beauty and freedom (Morse, 1959). Consequently, its use in arts is comprehensive and is observed in diverse forms such as painting, music, dance, architecture, sculpture, and textiles (Czerniak, 1999). The use of mathematics in arts is bonded since ancient history. Evidence in history was found indicating mathematics being used yet not being acknowledged as a separate entity by the individuals using it. For instance; Leonardo da Vinci illustration of *De Divina Proportione* in 1509 used the golden ratio, Albrecht Durer was an engraver who used mathematics in *Melencolia I*, Piero Della Francesca's use of mathematics in *De Prospectiva Pingendi* and other paintings (Field, 1997). These artists were familiar with mathematics and its use yet weren't aware of it being a separate field with significant importance. Background of Islamic art used symmetries in various forms such as Mughal Jali, Muqarnas, and Persian Girih was also founded (Özdural, 2000). These findings indicated the level of mathematics surrounded in the daily lives of individuals without them knowing it.

(Schattschneider, 2010), presented a semi-modern graphic artist M.C Escher who made use of geometry and tessellation with the help of H.S.M Coxeter a mathematician. MC Escher was one of the prominent findings that embraced geometrical forms and tessellations, with the help of thorough research. M.C Escher was a Dutch graphic artist who wanted to draw things with multiple perspectives which is why he experimented with maths too. Other artists with profound knowledge in mathematics also used in their work which includes: Peter Forakis (1927-2009), Charles O. Perry (1929-2011), and Hamid Naderi Yeganeh (1990- present) (Ornes, 2019). A recent wave of work from home has also emerged in the world of architecture. The trend of online websites and social media websites play a vital role for artists who work from home. Similarly a famous artist Ryan Carl, who works from home has gained enough popularity since he has worked with Nike, Google and others (Carl, 2019). The existence of artists who are familiar with different concepts of mathematics and use them in their work helps in understanding the significance of mathematics in arts and its related fields.

Ideation

The literature background help me broaden my horizon and so I opted what M.C Escher did. The work done can be comprehended with the term visual metamorphosis. Visual metamorphosis is referred to as shape-shifting art with which an artist can transform a shape by

representing one item into a similar shape (Koerner, 1993). I have taken inspiration from the existing work of other artists (M.C Escher & Ryan Carl) regarding this visual technique which is consequently explained in Methodology.

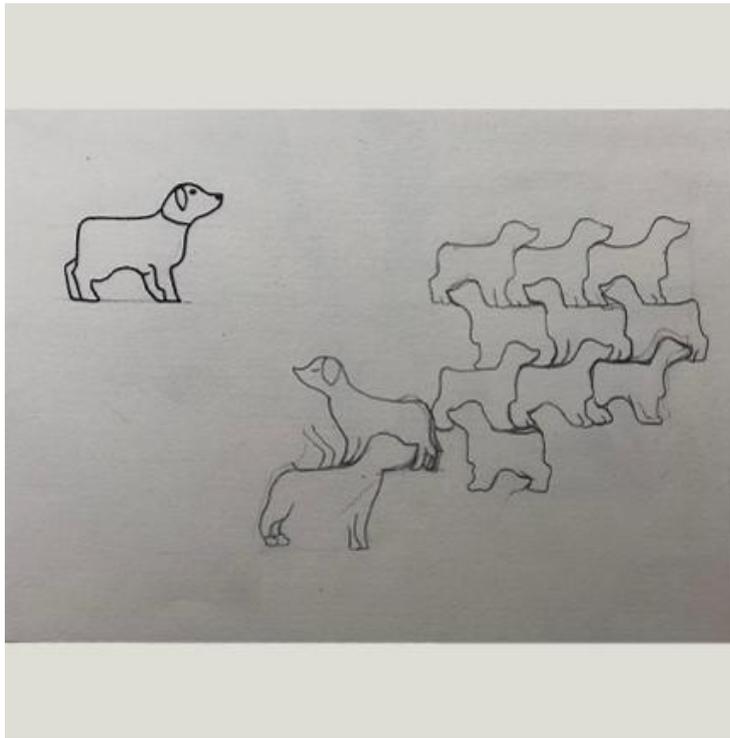
Methodology

The visual prowess of metamorphosis has been implemented. The concept itself had the feature which allowed it to be used in multiple shapes depending on different categories. The category I opted for was animals. At first, I tried different animals and repeated them at different angles. The most common animals that could be seen while repeating the shapes were bat, butterfly, and fish. So, I decided to change my animal. The animal, in particular, was a dog, the reason to do so was due to it being closer to the shape of a rectangle. Moreover, at first, the daily grinding of manual work was done which is presented in the following image. Initially, I simplified the dog and stylized it so I could repeat it easily at different angles. While repeating the dog, I could see animals like seahorse and seal but the tricky part was to simplify them and fit in the shape. So, I decided to go with one animal. For that, I drew the dog on the butter paper and used the same size of the head between legs so that the head of the other dog could fit in between the legs of the upper dog. For fitting two dogs within the same shape was very difficult but for accurate measurements, I used the graph paper so that the shape can be easily morphed with the same measurements of head and the space between legs. I repeated the dog upside down then, left and right, and followed the same pattern. On graph paper, the size of head was **12x8** blocks and to fit in the head between legs, the same number of blocks were left. **15x16** blocks were used for length and height of dog out of which **5x5** blocks were used for both legs.



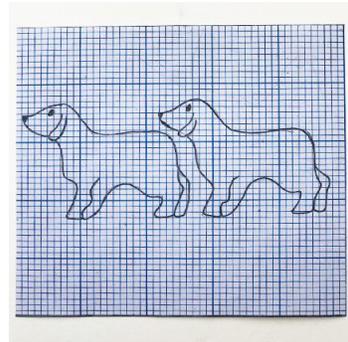
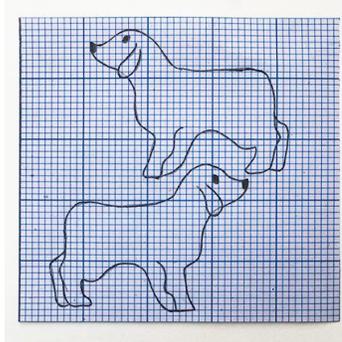
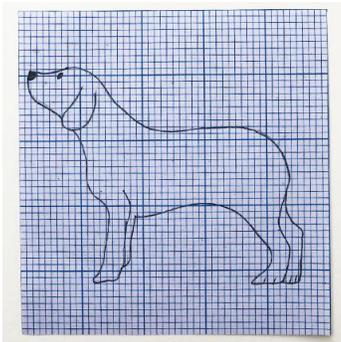
Process:

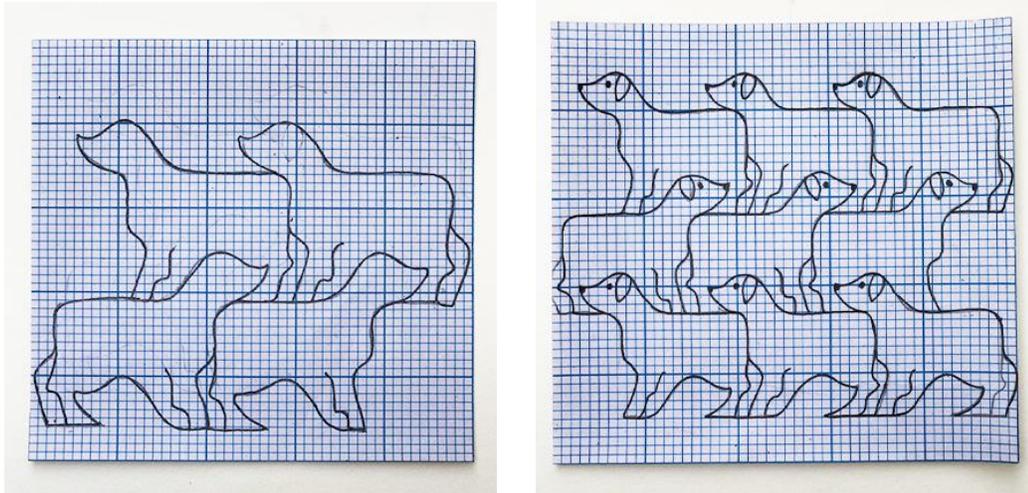
Step one:



Simplified the dog and repeated it at different angles.

Step two:



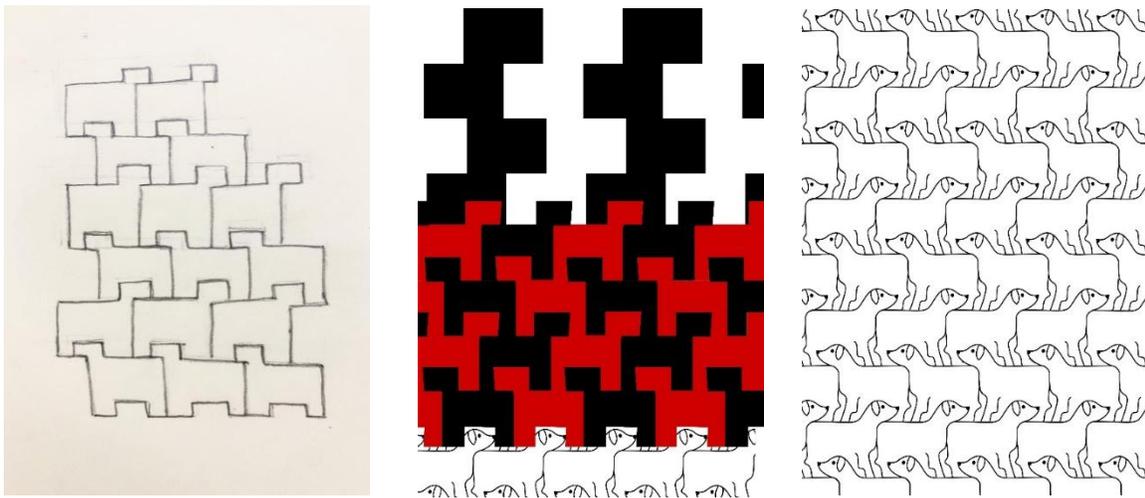


For accurate measurements, draw the dog on graph paper for same values of head and space between legs and repeated it upside down and right left.

Step three:

Then the medium came to the rescue resulting in the work to be completed digitally. Therefore I restricted the use of shapes to a single one which was a dog. The dog was molded in a way to illustrate a rectangle that was fixated in a different ways as shown in the following image.

Medium: The medium utilized was a digital medium. The illustration was completed with it.



Title

The title of the work is '*Never ending cycle*' because metamorphosis is a biological process by which an animal physically develops after birth or hatching, involving a noticeable and relatively immediate change in the animal's body structure through cell growth and this process is never

ending. The repetition of dog in this illustration creates a pattern which is never ending. It doesn't have any ending point and it goes on and on.

Future Perspective

Taking a backward glance to the amazing work of artists. This genre is quite malleable and can be used in diverse ways. Using different shapes to represent different shapes is quite unique and can exhibit symbolism. An art with symbolism would truly be magnificent. Time and complexity constraints were the reason that I could't explore this genre too much. Hence I aspire to reach out the young blood so that they could also work with this genre.

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