Symmetry in Chinese Paper-Cuts

Symmetry is used almost everywhere, ranging from designing buildings to handcrafts like Chinese Paper-Cuts. It has always been a mainstay of aesthetics from the beginning. Its influence in the arts is pervasive and creates a balance. It is an emblem of the human predilection for just proportion in all things and the longing for rational comprehension. This project aims to outline the permeations of symmetry especially in Chinese Paper-Cuts. Through a systematic investigation of cultural objects, I found the principles behind the structural systematic graphics.

Paper-Cutting is one of the most popular and traditional arts in China. Chinese paper-cutting originated from ancient activities of worshipping ancestors and gods, and is a traditional part of Chinese culture since Cai Lun invented paper in the Eastern Han Dynasty. After hundreds of years' development, they become a very popular means of decoration among folk. The main tools are simple: paper, scissors and glue. Deft craftship is essential to create life expressions of the figure's sentiment and appearance, or portrayal of natural plants and animals' diverse gestures. Paper-Cuts usually have symmetrical patterns – either Cn, which is n-fold cyclic symmetry and no reflection symmetry, or Dn, which is both n-fold cyclic and reflection symmetry. The Symmetry in Paper-cutting is usually created by some folding over a proportioned crease, and then cutting a shape. They must delete secondary parts and compose the main body properly, abstractly and boldly. When the paper it unfolded, it forms a symmetrical design. The paper cut outs involved are usually in an even number series of 2, 4, 8, 12 or 24 because they are the lucky numbers in Chinese culture.
Analysis of Chinese Paper-Cuts

Figure 1 is asymmetric for it has no translational, glide, rotational or mirror symmetry. Figure 2 is 2-fold rotational symmetry, which is C2, and no reflection symmetry. Figure 3 has a 4-fold rotational symmetry, C4, and no reflection symmetry, giving rise to various types of rosette pattern whose main object is the combination of the horse and the rabbit.

Figure 4 has a vertical mirror axe, which makes it D1. Figure 5, as a 3D object, has a C4V symmetry for it has a vertical mirror axe and four identical sides.
Process of making Cn Symmetry in 2D Paper-Cuts

Step 1. Fold a square piece of paper once

Step 2. Find out the angle to fold, in this case, if we want to make a C3 symmetry object, the angle should be $180 / 3 = 60$ degree, this is where the C3 is created

Step 3. Fold the right side of the three sections onto the middle one, do the same thing to the left side of the three sections

Step 4. Draw the half of the pattern of the object that will be presented in the later C3 symmetry for the object itself has a mirror axis

Step 5. Cut off the redundant part along the frame that is drawn, in this case, the white part

Step 6. Unfold it to make it a 2D C3 object
**Process of making 3D Paper-Cuts**

Step 1. Create two diagonal shapes of creases

Step 2. Follow the creases to fold it to a small triangle that has four layers. This is where the D4 symmetry is created.

Step 3. Draw the frame of the half of the character “Spring” (春). This is where the mirror axe is created.

Step 4. Cut off the unnecessary parts along the frame that is drawn.

Step 5. Unfold it to make it a 3D C4V object.

Reference: