

A Guide to Creating Escher-like Bird Motif Tessellations

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Abstract

The aim of this paper is to act as a guide to creating original Escher-like bird motif tessellations by a different process than is generally given in 'how-to' guides in books and articles. The method has as its premise simplifying the structure of a real-life bird, and then applying this to an existing tessellation.

Introduction

Concerning the design aspect to creating Escher-like tessellations, two different ways are generally given: (1) with changes to a given tessellation and (2) starting with a given motif and then 'adapting' this by distortion as a tessellating tile. Both of these 'design techniques' are shown in [5]. However, a different approach is possible, based on the observation of the underlying structure of the motif. The premise is that the structure is then greatly simplified, and then applied to existing tessellation tiles. To this end, the paper concerns bird motifs, these being a highly suitable tessellation motif, as discussed by Escher in [1]. The explanation is in two main parts, with background aspects, followed by application to tessellations in a 4 x 4 format. Once understood, it will then be possible to apply the method, enabling one to devise one's own original bird motif tessellations.

Part 1 - Background Aspects

Figure 1 shows a photograph of a real-life bird in a typical representation, seen from below, with outstretched wings. A feature of this is that of a cruciform outline, shown simplified with an overlaid cross. Separated as in Figure 2, the stick-like diagram can be said to be bird-like (head (H), wings (W), and tail (T)), in the same manner as of the well-known drawing of stick-man to represent a person.



Figure 1: Real-life bird

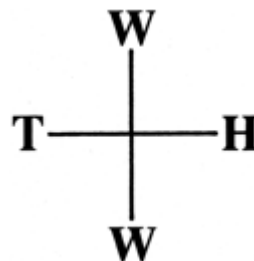


Figure 2: Stick-like cross

Part 2 - Application

Therefore, having established the principle, this is now applied to two arbitrary suitable examples (with tiles taken from given tessellations), in three steps, Figures 3 and 4.



Figure 3: Steps a-c



Figure 4: Steps a-c

The ‘thought process’ can be discerned as three distinct stages. (When familiarised with the method, it will be found that such procedures will be unnecessary, as the ‘mind’s eye’ will instantly see the possibility without the need of composing each stage.)

a. The premise of the method is that of fitting the stick-cross inside the figure. This is where imagination comes into play, albeit of a very low level – can you see how the cross fits inside?

b. In this instance, it should be obvious. As guidance, one can then add the basic elements, namely the head, wings, and tail to the tile (in this instance, as both tiles have 4-fold rotational symmetry, whichever ‘end’ is chosen is immaterial). Therefore, essentially, one has noticed the possibility of a likely bird motif.

c. The addition of the bird motif completes the design aspect.

Finished Tessellations

Having designed the motifs, both of these are shown as finished tessellations, in 4 x 4 formats, with 4-fold rotational configurations (Figures 5 and 6). Note that this is not the only possible rotational example of this type, as additional configurations are possible. For example, when the tile has rotation or reflection symmetry, the placement of the bird motif inside the tile offers further possibilities. In this instance, the Greek cross has eight possible 4 x 4 rotational configurations.

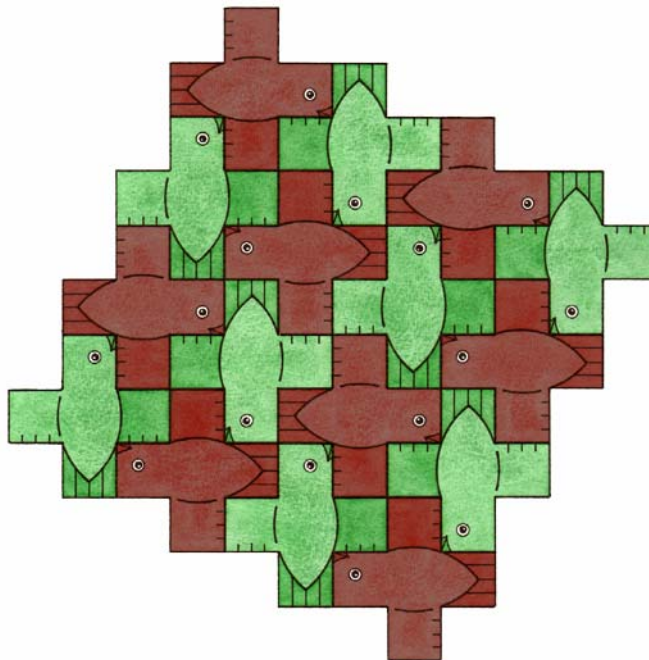


Figure 5: Tessellation of Figure 3

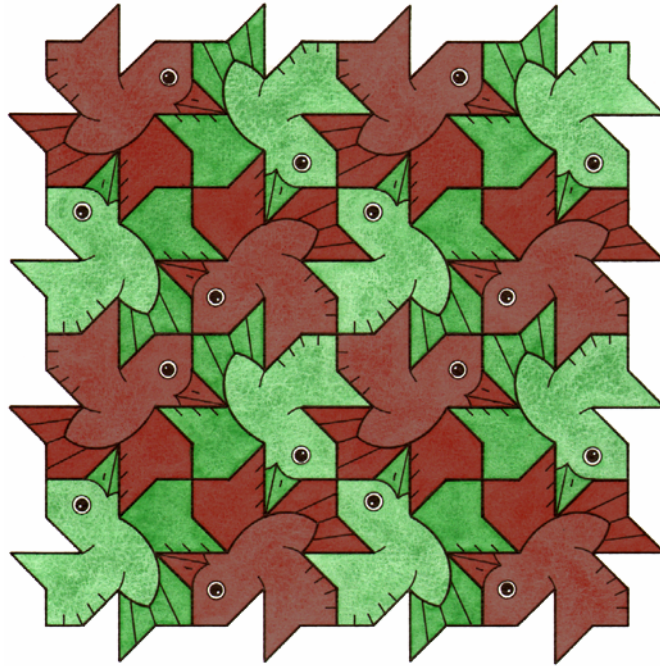


Figure 6: *Tessellation of Figure 4*

Further Possibilities

Upon establishing a 'geometric' type of bird, it is possible to build upon this with other types. Using the Greek cross for demonstration purposes, arcs (Figure 7) and 'free-form' lines (Figure 8) replace the straight lines to give a less 'severe' bird. It is possible to assess these in two ways: as independent examples of their own type, or as a sequence leading up to an ideal bird that is as realistic as is possible.

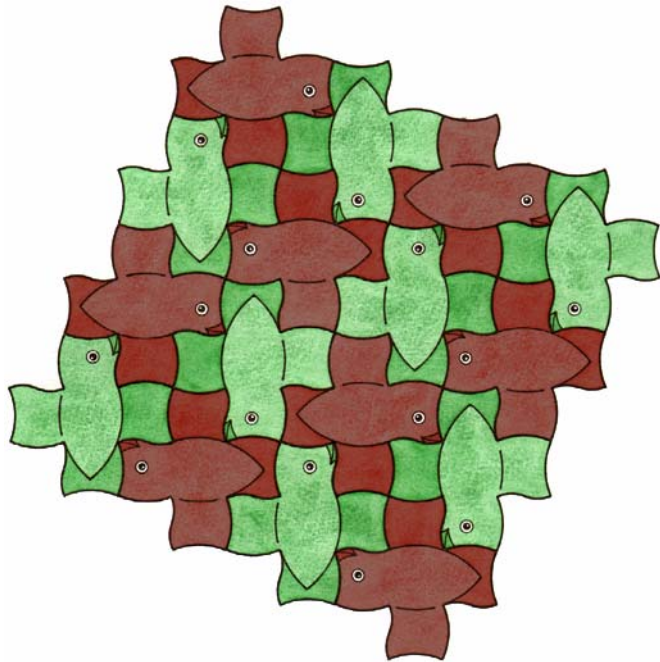


Figure 7: *'Arc Greek cross' tessellation*

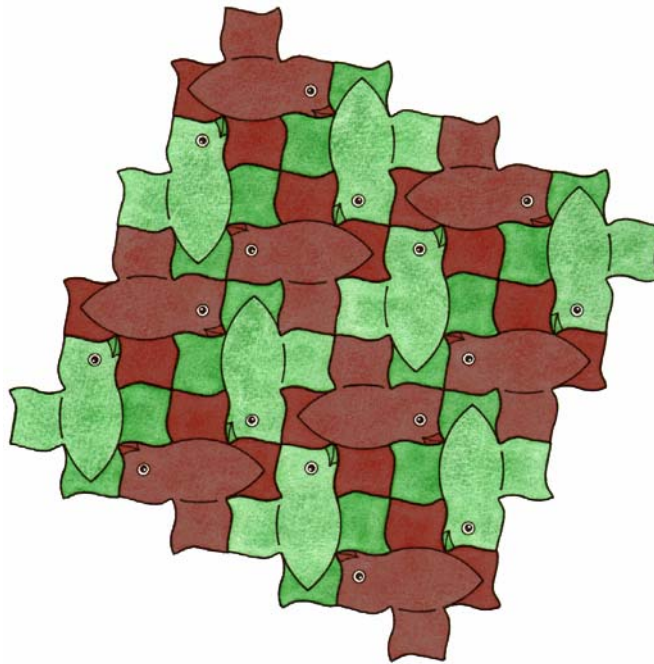


Figure 8: ‘Free-form Greek cross’ tessellation

The Computer and its Application in Designing Escher-like Tessellations

Concerning the designing of one’s own Escher-like tessellations, an open question is to ask if a computer can aid the process. Various computer programs have arisen since the time of Escher, for example *Escherization* by Craig Kaplan and David Salesin [2] and *Tessellation Exploration* by Kevin Lee [3]. These programs are fundamentally different; Kaplan and Salesin’s program is of a goal shape being adapted to a given tessellating parameter, whilst Lee’s program is in effect the equivalent of designing with an electronic pencil. Whatever the method used, the decisive test is the quality of the motif produced, i.e. its resemblance to the motif it is portraying. As such, I consider that they fall short in this aspect. Although I have tried the software, these lack the dexterity of the control possible as afforded by hand with drawing implements. Indeed, Doris Schattschneider [6] considers that Escher would not have used a computer for the design process. Perhaps the best use of computers at present is in the purely mechanical task of showing large numbers of motifs and subsequent colouring. More to the point of designing Escher-like tessellations is the *understanding* of tessellation aspects, such as why certain motifs are more suitable than others are. By such simple methods as outlined by this paper, the design of quality tessellations is possible without the need of computer assistance.

Rather than designing tessellations from the beginning, numerous suitable examples are readily available in books [4]. Obviously, utilising existing examples has the advantage of immediacy. Furthermore, with a practised eye, it is easy to make assessment as regards suitability with the minimum amount of time and effort.

References

- [1] F. H. Bool *et al.* *Escher The Complete Graphic Work*. Thames and Hudson, 1992.
- [2] Craig S. Kaplan and David H. Salesin. “Escherization.” In *Proceedings of the 27th International Conference on Computer Graphics and Interactive Techniques (SIGGRAPH)* 499-510. New York: ACM Press/Addison Wesley, 2000.
- [3] Kevin D. Lee. *Tessellation Exploration*. Sherston Software Ltd. Tom Snyder Productions, 2001.
- [4] P. A. MacMahon. *New Mathematical Pastimes*. Tarquin Books, 2004.
- [5] E. R. Ranucci and J. L. Teeters. *Creating Escher-Type Drawings*. Creative Publications, 1977.
- [6] Doris Schattschneider. *Visions of Symmetry*. Thames & Hudson, 2004.