Tales of Escher and Tiling Hyperbolic Space

Grant Sanderson

3Blue1Brown, Wisconsin, USA; grant@3blue1brown.com

This talk describes the evolution of M. C. Escher's interest in tiling patterns, originally inspired by Moorish architecture, and later evolving into a fruitful set of correspondences with several mathematicians. Pólya's description of the 17 wallpaper symmetries [2] inspired more intricate Euclidian tilings in Escher's work, and via his exhibit at the 1954 International Congress of Mathematicians this led to further correspondences with Coxeter.

Figure 1 displays an image from Coxeter's 1957 symposium "Crystal Symmetry and its Generalizations" [1] depicting a hyperbolic tiling on the Poincaré disk, with Escher's sketches on top trying to reverse engineer how the figure was created. Escher recorded that he was given "quite the shock" upon first seeing this image, which inspired a series of works that culminated in his circle limit series.

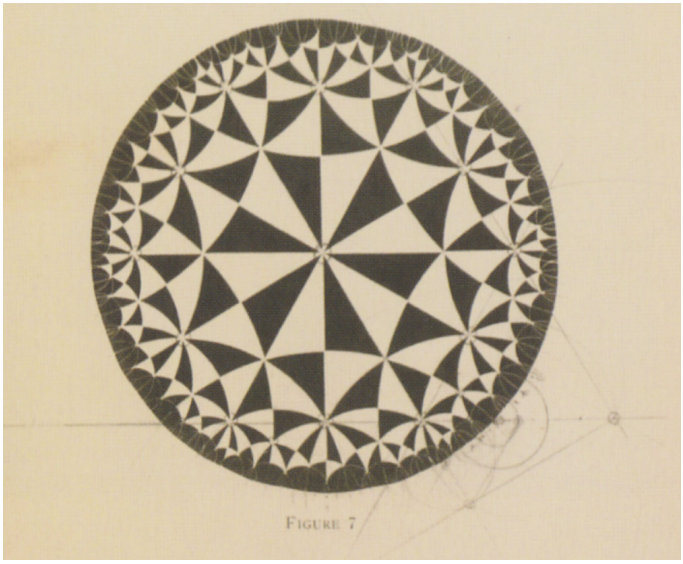

Figure 1: *Illustration of hyperbolic tiling from Coxeter with Escher's sketches on top.*

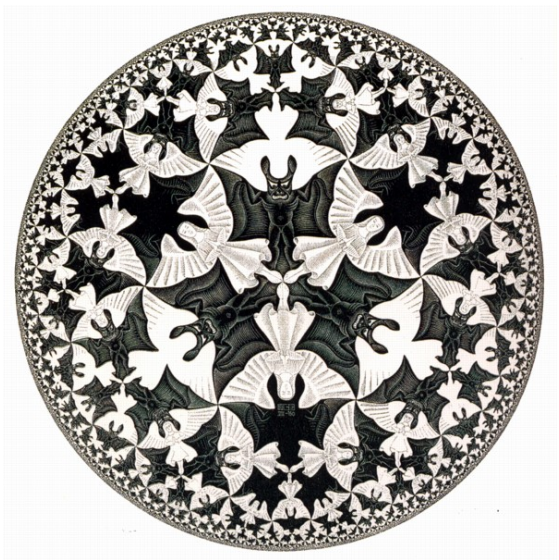

Figure 2: *M. C. Escher's Circle Limit IV.*

References

[1] H.S.M. Coxeter. "Crystal symmetry and its generalizations." *Transactions of the Royal Society of Canada*, Series III, Vol. 51, Section 3, 1957, pp. 1–13.

[2] George Pólya. "Über die Analogie der Kristallsymmetrie in der Ebene." *Zeitschrift für Kristallographie*, vol. 60, 1924, pp. 278–282.