Geometer Rachel Fletcher introduces the Geometer's Angle, a column in the Nexus Network Journal dedicated to geometrical constructions, the procedures for drawing them, their use, significance and symbolism.

Image: The Wilson A. Bentley (1865-1931) collection of photomicrographs of snow crystals (negatives 3879, 2001, and 3307). Reproduced by permission, the Buffalo Museum of Science; geometric overlays by Rachel Fletcher

Geometry is from the Greek *geōmetria* (from *gē* “earth, land” + *-metria* “measuring”), which means “earth measure” as in “surveying the land” [Hoad 1996, Liddell 1940, Simpson and Weiner 1989].

Herodotus believed the Greeks imported it from Egypt, where it was used to calculate lands that were lost to the annual flooding of the Nile [Herodotus 1998 II, 109, 136]. In fact, geometry dates to our ability to count and to translate number into spatial pattern. It appears in prehistoric structures and is practiced everywhere by children at play.

Geometry as a technique for spatial organization evolved in western culture from ancient Egyptian sages and surveyors and from Greek philosophers. It was preserved by master builders of Gothic cathedrals and later revived by humanists and artists of the Renaissance. It continues to influence the way we see the world today.

Geometry informs the perennial question of unity in a complex world. Regular geometric figures—the triangle, the square, and the pentagon—contain specific ratios and proportions which can mediate diverse elements and quantities. We will set aside questions of whether or when such proportions were applied historically to architecture and art, or whether geometric patterns are divinely inspired, fixed within the natural world, or imposed from without by human perception and intelligence. Our purpose is to explore how such proportions enable architects, designers and artists to accomplish unified schemes from a diversity of elements.

The Greek for “symmetry” is *summetria* (from *sun-* “together with” + *metron* “measure”), which means “suitable relation” and “due proportion” [Liddell 1940, Simpson and Weiner 1989]. Symmetry is often understood to be the bilateral arrangement of parts in anatomy or biology or else the method of crystal classification where the whole is divided into a number of identical

elements, then uniformly distributed around a point, a line or a plane. Symmetry that is “axial” or “radial” presumes a world of homogeneous elements. It requires the mind to assemble thoughts in a polarized fashion and to perceive space divided into uniform fragments and parts.

But symmetry can be synonymous with “proportion,” which means “the harmonious relation of parts to each other or to the whole.” The Greek for “mathematical proportion” is *analogia*, from *logos*, which may mean “computation,” “relation,” “principle” and “the word, as in the expression of inward thought.” “Proportion” is from the Latin *proportionem*, “comparative relation, analogy,” which is adapted from *proportione*, “in respect of one’s share.” [Liddell 1940, Simpson and Weiner 1989]. Symmetry that is “proportional” or “relational” presumes a unified world in which unique differences may be preserved, yet integrated. It organizes space according to mutually related parts and whole.

Incommensurable proportions inherent in regular geometric figures are uniquely suited to patterns of “relational” symmetry. Let us explore such proportions through elementary geometric constructions.

References

- HARPER, Douglas. 2001. *Online Etymological Dictionary*. <http://www.etymonline.com/>
- HERODOTUS. 1998. *The Histories*. Trans. Robin Waterfield. Oxford: Oxford University Press.
- HOAD, T. F., ed. 1996. *The Concise Oxford Dictionary of English Etymology*. *Oxford Reference Online*. Oxford: Oxford University Press. <http://www.oxfordreference.com>
- LIDDELL, Henry George and Robert SCOTT, ed. 1940. *A Greek-English Lexicon*. Henry Stuart Jones, rev. Oxford: Clarendon Press. *Perseus Digital Library Project*. Gregory R. Crane, ed. Medford, MA: Tufts University. 2005. <http://www.perseus.tufts.edu>
- SIMPSON, John and Edmund WEINER, eds. 1989. *The Oxford English Dictionary*. 2nd ed. *OED Online*. Oxford: Oxford University Press. 2004. <http://www.oed.com/>