Self-Similarity

A property in which a form is made up of parts similar to the whole or to one another.

Many forms in nature exhibit self-similarity, and as a result it is commonly held to be an intrinsically aesthetic property. Natural forms tend to exhibit self-similarity at many different levels of scale, whereas human-created forms generally do not. For example, an aerial view of a coastline reveals the same basic edge pattern, whether standing at the waters edge or viewed from low-Earth orbit. Although varying levels of detail are seen, the same pattern emerges—the detail is simply a mosaic of smaller wholes.¹

Naturally occurring self-similarity is usually the result of a basic algorithmic process called recursion. Recursion occurs when a system receives input, modifies it slightly, and then feeds the output back into the system as input. This recursive loop results in subtle variations in the form—perhaps smaller, skewed, or rearranged—but is still recognizable as an approximation of the basic form. For example, a person standing between two mirrors facing each other yields an infinite sequence of smaller reflections of the person in the opposing mirror. Recursion occurs with the looping of the light between the two mirrors; self-similarity is evident in the successively smaller images in the mirrors.

The ubiquity of self-similarity in nature hints at an underlying order and algorithm, and suggests ways to enhance the aesthetic (and perhaps structural) composition of human-created forms. Consider, for example, the self-similarity of form and function found in the compound arch structures of the Roman aqueducts and the flying buttresses of gothic cathedrals, structures that are beautiful in form and rarely equaled in their structural strength and longevity. The self-similarity in these structures exists at only a few levels of scale, but the resulting aesthetic and structural integrity are dramatic.

Consider self-similarity in all aspects of a design: story plots, visual displays, and structural compositions. The reuse of a single, basic form to create many levels of metaforms mimics nature’s tendency towards parsimony and redundancy. Explore the use of basic, self-similar elements in a design to create interesting organizations at multiple levels of scale.

See also Archetypes, Propositional Density, Similarity, Symmetry, and Visuospatial Resonance.

Fractals demonstrate self-similarity on virtually every level of scale. This image of the Valley of Seahorses region of the Mandelbrot Set demonstrates the extraordinary complexity and beauty of self-similar forms.

M. C. Escher explored self-similarity and recursion in much of his work. In his Smaller and Smaller, a single form perfectly tiles with successively smaller self-similar forms to create a reptilian tunnel of infinite depth.

The photomosaic technique developed by Robert Silvers creates stunning meta-images from unlikely combinations of miniature images. The photomosaic of the Mona Lisa comprises 800 classic art images and demonstrates the power of self-similarity at only two levels of scale.