FORM + CODE

IN DESIGN, ART, AND ARCHITECTURE

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A GUIDE TO COMPUTATIONAL AESTHETICS

VARIABLES

In any system or set of rules, there exists the potential for variation. Though the primary variation of form present in a Calder mobile comes from the unpredictable interaction of natural forces, it is still possible to get an even wider field of possibilities by changing other parameters in the system. These include the lengths of the rods, weights of the objects, and positions of the connections. A compositional system built out of 1-foot (0.3-meter) rods will look and behave very differently than a system made of 1-meter (3.3-feet) rods.

When the value of a parameter can change, we call this a variable. Variables can be distinguished from constants, whose values cannot change, such as the force of gravity; or constraints, which are fixed in response to the requirements of the project, such as cost or available materials, and provide boundaries that define the edges of a design space. The creation of a mobile, for example, may be constrained by the size of the room it will hang in and the need for it to be light and strong enough to hang from the ceiling. Though all three of these parameter types will effect the range of possible forms, the variables can be considered as the primary axes of variation. The artist changes the variables, either by hand or with code, in search of interesting outcomes.

Sometimes the variable's value will only makes sense within a certain range. Consider the tuning knob on a radio; only frequencies within the range shown on the dial are valid. It is conceivable that a radio could use values outside of this range, but the results will be unexpected, and certainly won't sound like radio. Defining the range of values is one way that designers can assert their aesthetic sensibilities in a parameterized system. Perhaps not all values will look good or create interesting results. Much like the dial on the radio, the range can be refined to produce a narrower, but more pleasing field of variations.

As with the compositional systems in use prior to the invention of the personal computer, randomness is a useful tool for finding interesting variations in a parameterized system. Random values can be used to emulate unpredictable qualities of our physical reality and to generate unexpected compositions. Though not as random as a toss of the dice, code provides a more flexible way to create random values. Sequences of random numbers can be generated in such a way that each number in the sequence differs only slightly from the last; this technique aids in the simulation of natural effects like wind, waves, and rock formations.[4] Although using random numbers to find interesting variations is not an efficient way to discover every possible form, it does provide a way to explore an exhaustively large parameter space in order to get an idea of possible outcomes. Even in a small system that uses only three parameters, each of which has a value from zero to 100, there are a million possibilities—far more than one can explore methodically.

[4] Ken Perlin greatly impacted the computer graphics world with his invention of Perlin Noise in 1985. This method for generating textures is widely used in computer graphics to create visual effects like smoke, fire, clouds, and organic motion.

PARAMETERIZE
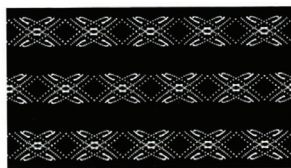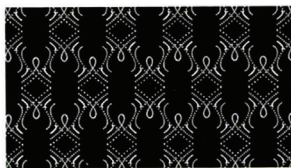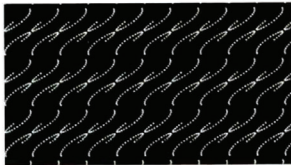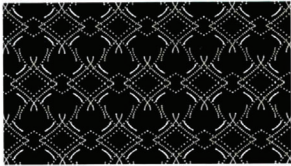
Two Space, by Larry Cuba, 1979 Cuba combined a set of nine tiles with twelve symmetrical pattern arrangements to create a mesmerizing animation. The white-on-black scheme creates optical illusions, figure-ground reversals, and after-image effects. The parametric organization of the software allows for any of the tiles to be combined with any of the patterning schemes.