PROGRAMMED DESIGN: THE SYSTEMATIC METHOD AND THE FORM OF PATTERN

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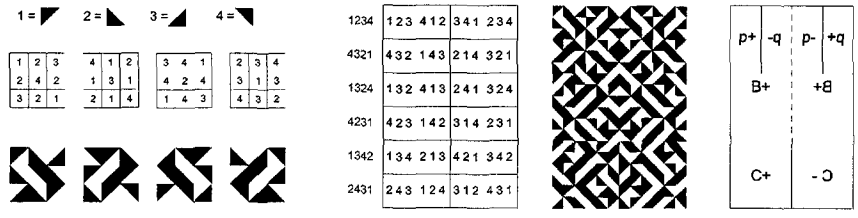
Abstract: *A programmed design project I did in school after studying in Professor William Huff's Basic Design Studio has resulted in my interests in pattern study and the systematic method. What I found particularly fascinating is, how complex form can be generated by a simple system, and how the rigorousness of logic and the variability of form, or simplicity and complexity can work so perfectly together, and further, how this can be applied to architectural design and urban study, or other artistic creation.*

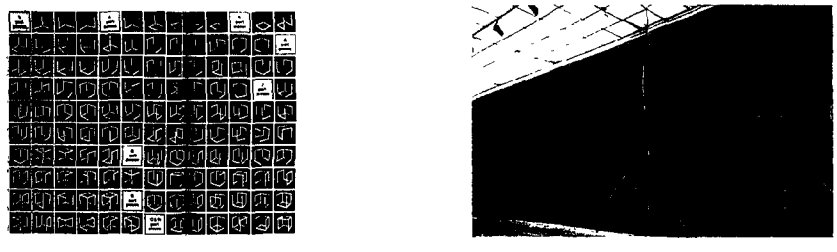
A Programmed Design: A group of four elementary squares, each subdivided by triangles in an asymmetrical manner, are arranged in a 9-square square – each dictated by three regulating subsquares. This square is continuously transformed as it translates four times across and six times down while the three regulating subsquares shift in the numerical patterns of 123/412/341/234 across and 123/432/134/243/142/324 down – this closed group forms one panel. By rearranging the position of triangle in the elementary squares or changing their sequences, a different panel is generated. Through combinatorics, a total of 24 panels are generated – each displays areas of mirrored symmetry and mirrored antisymmetry.



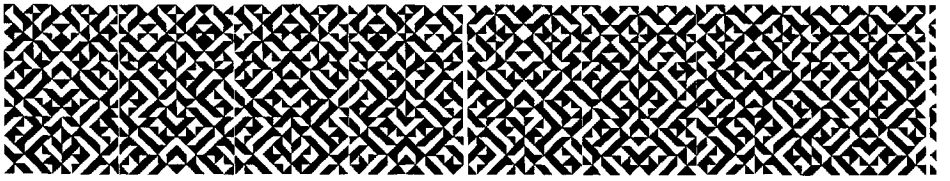
Programming "cells" and a closed panel.

The above programmed design is presented here both as an example of how to generate a complex pattern by a mathematic system, and a case study of pattern But the application of systematic or structural methods is not limited in the design field There have been many works from various disciplines that are created in this approach, such as the music of Arnold Schoenberg and Steve Reich; or the literary writings of Jorge Luis Borges and Italo Calvino; or the "serial" constructions and wall drawings by Sol LeWitt.

For example, Sol LeWitt's *Variations of Incomplete Cube* is a juxtaposition of all the open cubes of 3-edge (minimal sides of a cube) to 11-edge (12-edge will be a complete cube). His wall drawing *All Combinations of Arcs From Corners & Sides; Straight, Not Straight, And Broken Lines* is another such kind of construct through combinatorics. It is a sequence of all the 190 combinations of any two basic elements listed on the title – an exhaustion of all the possibilities of a preset system. For Sol LeWitt, the appeal of this approach lies on being "the way of creating art that did not rely on the whim of the moment, but on a consistently thought out process that was interesting and exciting", and from which, "the realizations of straight-forward ideas often turn out to be unexpectedly beautiful". (Sol LeWitt and Andrea Miller-Keller, from *Sol LeWitt: Twenty-Five Years of Wall Drawings, 1968-1993, p39.)*



Sol LeWitt: Variations of Incomplete Cube (left) and *All Combinations of Arcs From Corners & Sides; Straight, Not Straight, and Broken Lines* (right).



Part I of the final pattern.

Combinatorics, or "ars combinatorial", also takes a prominent role in the formalism of Italio Calvino's writings Take his *Invisible Cities* as an example. The book consists of a series of short stories of eleven subjects ("memory", "desire", etc.), and is structured in the order of number "5" in a music-like sequence. If we letter the 11 subjects as A to K, then Chapter One – the introduction – will be in the order of (A1/A2, B1/A3, B2, C1/A4, B3, C2, D1). As soon as the number goes up to "5", the book enters into Chapter Two of (A5, B4, C3, D2, E1) and then Chapter Three of (B5, C4, D3, E2, F1). As such, the same pattern is repeated from Chapter Two through Chapter Eight, while the subject/letter continuously fading in and out. Then in Chapter Nine, the order becomes: H5, I4, J3, K2/I5, J4, K3/J5, K4/K5 – as an ending, formally if not thematically, appears both as an echo and an inversion of Chapter One. And by this, all combinations of numbers and letters are complete Through this compositional method, what is presented in the book is not a conventional storyline, but the interweaving of multiple layers and the complex texture of a city.

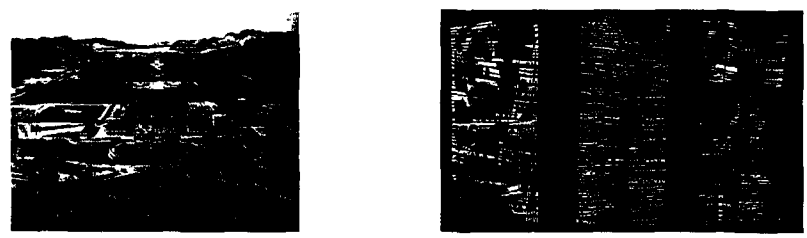
Compare these examples with the programmed design at the beginning, there are some common characteristics of the projected patterns, either visual (3D & 2D) or textual or tonal, that need to be further noted and studied.

First is the contrast and interplay between the rigorous order and the apparent randomness of the pattern, and the simple repetition of basic elements and the complex variation of the results. What this observation tells us is: on one hand, the phenomena may seem random or even chaotic, but a logic can be always assumed hidden behind even though it may not be easy to discern, on the other hand, the sum of the set of orders may be simple, but its working can be highly complicated.

Further, what results from the generative system is not a composed figure, but a pattern by the autonomous operation of the system. In other words, the orders of the system may be conceptually or contextually referential, but the form they generate is completely self-referential. Thus, the usual figure-field relation is irrelevant here. A pattern itself is a field without singular focus or favours to any privileged point. Contrasting with the classical tradition that parts are governed by the overall formal relations (proportion, axis, etc.), in a pattern, parts are simply parts and all parts are equal. Each part is indifferent to or unaware of the form of the whole.

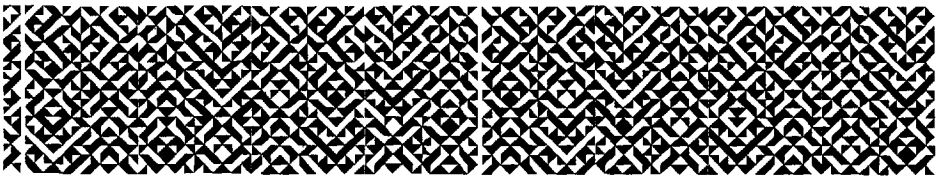
Yet, is defined only by its relations with its neighbouring parts. For example, in the programmed design at the beginning, a rotational relation defines each unit against its preceding and following unit without knowing the consequential symmetric or antisymmetric relations of the whole.

We should also note that the form of each basic element (e.g. the elementary squares with triangle in the programmed design) is independent of the system: while the underlying structure may be the same, the form of the element is changeable, and each change will cause substantial changes to the pattern, and vice versa. To use architecture and urbanism as an example. "absolute liberty is granted to the single architectural fragment, but this fragment is situated in a context that it does not condition formally. the secondary elements of the city are given maximum articulation; while the laws governing the whole are rigidly maintained" (Manefredo Tafuri· *Architecture and Utopia,* 1973, p38.)



Versailles (left, painted by Pierre Patel, ca. 1668) is an example of classical composition that emphasizes focal points and axes. Right: Bucuresti 2000 master plan by O.C.E.A.N. is an urban design example that uses systematic method emphasizing field conditions and patterns.

Finally, similar to algorithms, the set of rules that comprise the system usually address the conditions and procedures rather than an intended form. Thus, we have seen more uses of diagram for representation in the practice of such an approach than perspective and illustration. Also, since there are various factors, individuals, forces, and operational methods that are addressed by these rules, each system in fact comprises a number of smaller systems



Part III

As such, the proceeding of the system that results in the unfolding of the pattern is a complex act of superimposition and interaction between each individual system. Therefore, each system is in fact an open system, and is capable of variation and adjustment by accepting any changes or interference from any additional elements.

It is my belief that the understanding of pattern can help us to understand the complexity of nature and culture. What have been discussed above are just some basic observations, and I believe that the current cross-disciplinary studies on Complexity and System will provide a much boarder and stronger theoretical base. In a world that is both complex and dynamic, the static and homogenous nature of absolute control and unity has rendered the notion itself obsolete and inappropriate. However, a world without any order would prove to be too chaotic. It seems to be the balance and union between system and individuality, orders and chaos, logic and chance, structure and randomness, and repetition and variation that we would like to pursue. What is suggested here is, on one hand, we need to continue to find out the systems that are hidden behind the complex phenomena, on the other hand, we can apply these systems that we have understood to guide us, and help us to set up a minimal structure that can both maintain an order and allow the maximum possibilities and freedom.

References

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