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HAZARD

Abstract
Which automatic method, or algorithm, can generate special nonsense shapes able to evoke the maximum number of unexisting meanings in human visual perception? A bare measure of the most evocative fractal dimension is not sufficient. A long and systematic research to answer such question led me to discover special automatic dispositions (Quilting) of special nonsense stochastic tiles which can stimulate, in human perception, the maximum of different projective meanings ever reached. A new set of 50 stochastic tiles type B with complexity 30 and 50 stochastic tiles type C (20 of which with complexity 4 and 30 of which with complexity 6) were generated. A problem of dis-economy of scale prevented me from visualize all the possible combinations and obliged me to create a method I named HAZARD which approximates the most evocative composition possible. A sample of 12 Hazard paintings exhibited in several art galleries and museums during the last 3 years are shown.

1 – Bettering Rorschach

The search of perceiving hidden meanings in nonsense shapes has a long story, running from ancient diviners to the Rorschach test. The creation of mathematical algorithms generating nonsense shapes wich elicit the maximum evocative meaning is a problem faced by modern science as well, including fractal geometry, stochastic processes, theory of complexity and art creation. In spite of the big amount of investigations trying to discover the mathematical lows underlying the generation of the most projective (evocative) nonsense shapes, the Rorschach projective test till now is unsurpassed (Searls 2018). Even the recent explanation of Richard Taylor (Taylor 2017, Abbott 2019) claiming that the borders of a blot with a *medium fractal complexity* may stimulate projective interpretations is not sufficient to solve our problem. Actually the psychological and aesthetic problem is not "if" a stochastic, chaotic, or fractal shape can evoke projective meanings, but which algorithm, or automatic method, is more able to generate nonsense shapes evoking "the maximum" projective hidden meanings in human visual perception. This is why the Rorschach test is yet unsurpassed. Rorschach used an easy empirical method that was pretty well known by surrealist painters, but using the same method not even Andy Warhol (1984-2020) did equal or surpass Rorschach.

2 – Fractal complexity

Long ago I measured the differences in projective visual perception among random shapes of different complexity, finding that the most evocative would rank about 1,35 in fractal dimension (Lombardo 1983). Such result did not prevent me from many years of research before I discovered complex algorithms generating much more evocative shapes by manipulating the composition of stochastic tiles (Lombardo 1993). But it was only in 2018 when I found specific compositions of stochastic tiles, I named "Quilting" (Lombardo 2018), in which everybody could identify plenty of unexisting and unexpected anthropomorphic and zoomorphic objects.

3 – New stochastic tiles B and C Type

Recent quilting compositions may have a similar fractal dimension as I found in 1983, but the

evocative effect is much stronger. The secret to increase projective or evocative perception is the alternation, like in a chessboard, of stochastic tiles type B and type C (Lombardo 1994, 2012), type B being about seven times more complex than type C. Tiles of type C were named "bodies". Tiles of type B were named "limbs". A new set of 50 stochastic tiles type B (with complexity = 30) and 50 stochastic tiles type C (20 with complexity = 4 and 30 with complexity = 6) were generated, see Fig. 1.
A floor of 24 tiles (Fig.2a) was composed randomly picking up only from the LIMBS in Fig. 1 and rotating each tile as in Fig. 2a. A second floor of 24 tiles was composed randomly picking up only from the BODIES in Fig. 1 and randomly rotating each tile as in Fig. 2b. Both floors are randomly generated but the first is composed only with LIMB tiles and the second is composed only with BODY tiles. A third floor of 24 tiles was composed intersecting 12 tiles picked up from Fig. 2a and 12 tiles from Fig. 2b. The tiles were chosen intersecting chessboard like 12 cells from the LIMBS with 12 cells of the BODIES and reversal, in such a way as to obtain the 2 different intersections shown in Fig. 2c. The chessboard like intersections in Fig. 2C are consistent with the "quilting" model, and are much more evocative than the compositions with only LIMBS or only BODIES.

4 – Limits of minimal, complete, compact, toroidal compositions
In previous papers I found special stochastic tiles compositions which had the properties of minimality, completeness, compactness and toroidality. Being minimal a composition of n different tiles must have no repetition. Being complete it must employ all possible *side-to-side* combinations (first level of completeness), or it must generate all possible *combined-shapes* (second level of completeness). Being compact it must fill completely a rectangular floor. Being toroidal it must create horizontal and vertical cycles without braking minimality, completeness and compactness or braking combined-shapes on the borders.
Till now I have used 1, 2, 3 or 4 different tiles to make minimal, complete and compact compositions. The aim of my research is to create combined-shapes charged with the maximum evocative (projective) effect perceivable by normal people, which is different for different persons and different even for the same person if seen in different times. Such highly evocative combined-shapes are generated by algorithms without any input from my personal taste, my personal moral contents, manual ability or whatever subjective expression of mine. After long and complex experiments I found minimal, complete, compact and toroidal compositions named *Tiling* and *Quilting.* Such compositions improved the evocative power of my earlier compositions because it became possible to see at a single glance all the possible combined shapes generated with 1, 2, 3 or 4 different tiles. If I would construct minimal, complete, compact and toroidal compositions using more than 4 tiles to discover the most evocative combinations, I would impact the problem of dis-economy of scale (Lombardo 1979).

5 – Dis-economy of scale
All the possible dispositions of n different tiles T (rotations R = 4 each tile) into a floor of cells k = 24 are $(RT)^k$.
For T = 6, all possible dispositions are $24^{24} = 1{,}33373577685^{33}$
For T = 12, all possible dispositions are $48^{24} = 2{,}237637321515^{40}$
Considering only the 100 tiles created in this experiment ($400^{24} = 2{,}814749767107^{62}$), we guess that the requirements of completeness will crash onto a strong dis-economy of scale. It is impossible to plan an experiment to discover the most evocative combination among such a big number of possibilities. Thus we must follow a different path.

6 – Hazard compositions
As yet the only way left to the scientist is the *trial and error* procedure. We may generate as many compositions as we can, choose the most evocative composition among them, try many new

compositions again, measure if among them there is a composition more evocative than the one which previously resulted the most evocative, and so on endlessly. Such almost arbitrary procedure is used not only by scientists crashing onto the dis-economy of scale, but also for instance in sports, in arts, in cultural and political competitions. All these fields don't allow the ultimate best solution and new questions grow more rapidly than successful answers. The history of tentative answers is the human history itself. 10 attempts of mine, named Hazard, using a floor of 6 tiles are shown in Figs. 3-12.

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