Halving Processes in a Square

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Abstract

As a visual artist retired from a professional life engaged in architectural implementations, I come personally back this year to Bridges to share my passion for the square. I deliberately chose to present a significant range of the preparation work of my colorful geometric acrylic compositions, to help interested readers to decipher them, beyond a pleasing eye catch for the rapid proceedings browser. This shows how, as a non-mathematician, I consistently designed them for years according to a number of simple variations of the successive halving processes "halvings" of portions of the square, the apparent complexity stemming only from their pile-ups.

Background

The square shape constituted by 4 equal 90° corners and 4 equal length sides, associated with a rich collection of geometrical properties beyond my non-mathematical understanding, also symbolizes durability, security, equilibrium and the rational arrangement of space. It further represents honesty, integrity and morality and in China it was the symbol of Earth [3].

Figure 1: *Work example.*

Perhaps inspired by Karl Gerstner ideas [1], for more than forty years the halvings of the square almost fill entirely my artistic creations. My work contains a fascinating search of the structure and variability aspects of the square. It is not a cold approach of form, but an outspoken fondness of a certain abstract style, where the suggested geometrical contrasting surfaces also display warm feelings thanks to a harmonious use of color mixing, hence the particular climate of the work. The viewer grasps an acutely ordered geometric image often containing symmetries, yet in several respects seems subordinate to linear and color powers. See Figure 1 (Interested and puzzle gamer readers are urged to check out the colored and enlargeable online text similar to [2] to dig in !)

The quivering color play obtained from three or four transparent acrylic layers indeed conveys a ludical eye-caressing and powerful expressive presence to each canvas. Preference of red, blue and yellow tints, sometimes mixing into secondary colors, enrich the paintings thanks to a range of variants. The composition form, the paper essence, proceeds from pure geometric and mathematically assumed simple constructions: I work with successive halvings in the square, changing the new half in opposite color to obtain an alternation when at next step the last half is halved again, with the last half at each step being alternatively white or black.

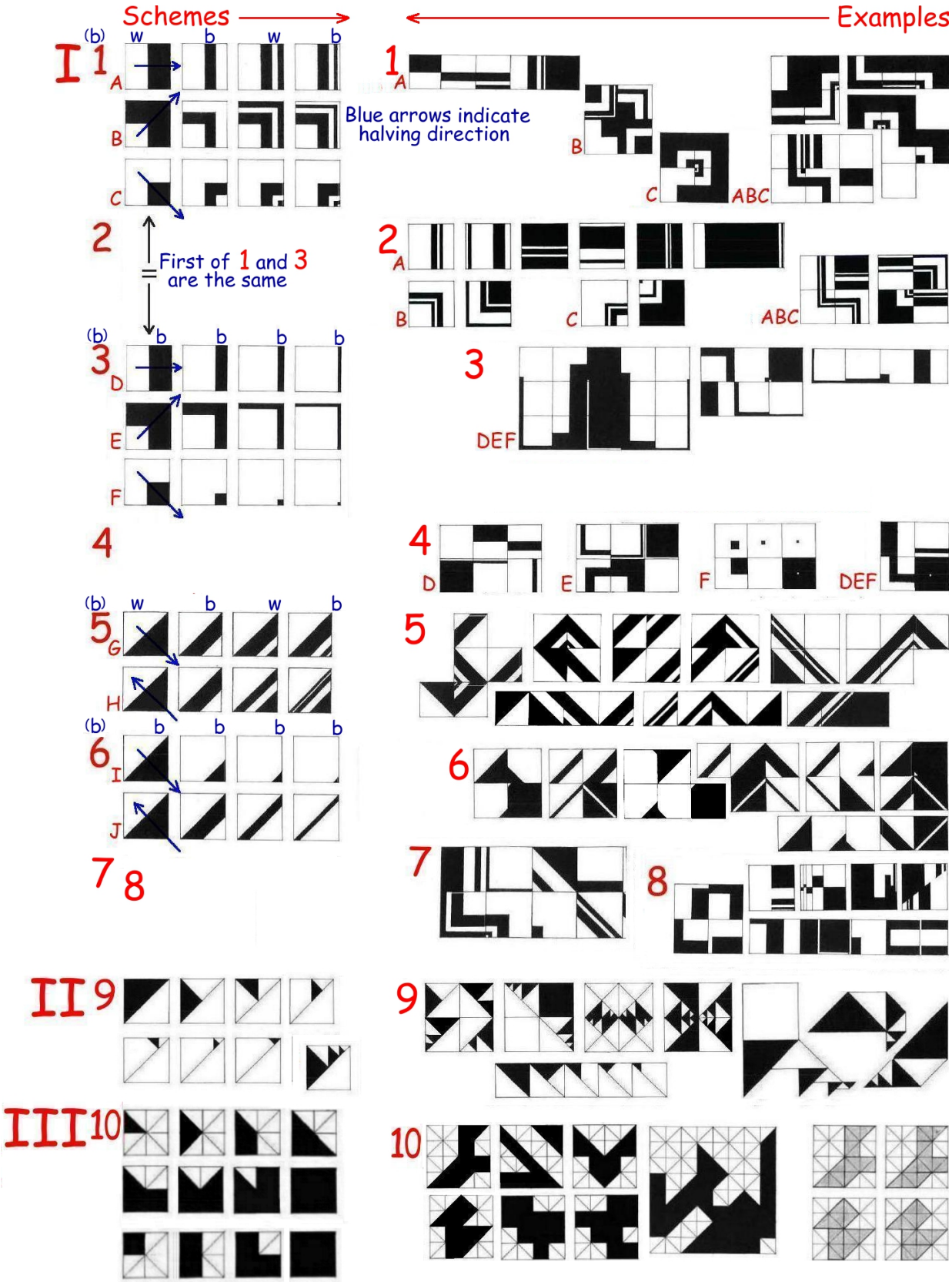

Figure 2: *Setup of 3 kinds of halving strategies and examples. See explanations on facing page.*

Explanations of Different Halving Schemes in Figure 2 on opposite page

Introductory remarks on how my main halvings operate (1st of 3 quite different parts I to III)

1. The left side of Figure 2 lists the halving schemes, and examples are right-justified at the right.

2.The first schemes I gradually developed (1, 3, 5, 6) and most likely to be used in my artworks show the first 4 elements of one of 8 infinite sequences of squares containing consecutive halvings.

3. These halvings work in 4 directions, only the first one is shown, born from a non-shown black square.

4. These 8 sequences of 4 directions indeed start from a black or a white square. The examples of their use here provided also contain parts generated from a white square as well as white and black squares.

Part I: Main Halving Schemes

1. I show successive early 4 of "what's left" (as observed by a Reviewer) in the square and include the previous ones in 3 kinds, what-lefts starting with alternating backs and whites as indicated in blue above, the full non shown original indicated between brackets. A: vertical halvings going to the right of the square are shown, possibly also going to the left, and possibly horizontal halvings going up or down of the square, B: corner halvings going outside to the upper right of the square are shown, also possibly going to the three other corners of the square, C: corner halvings going inside of the square down to the right are shown, also possibly to the three other directions. Examples of A, B and C separate, examples of A, B, C combining.

2. Any number of halves of point 1 above can change places in the square, possibly in the 7 non shown situations. Examples for A, B and C separate, examples for them combining.

3. As one simple possibility of above point 1, the 4 shown halvings D, E, F do not include the previous halvings and no longer represent a what's left situation and present only the last of the successive halvings in the square, possibly for all 7 situations non shown, with no accompanying alternate change of color as shown in blue above. Examples for D, E, F separate, examples for D, E, F combining. Despite another scheme, the first instances of 1 and 3 are identical as indicated by a black "=" between vertical arrows.

4. The previous 4 shown halvings D, E, F can also change places in the square, possibly for 7 other situations non shown. Examples for D, E, F separate and combined.

5. The 4 shown successive halvings G, H including the previous halvings are divisions in diagonals of the square. possible for 7 other situations non shown. Mixed examples for G, H separate and combining: funny exercise to sort them out by now!

6. As one simple possibility of above point 5, the 4 shown halvings I, J do not include the previous halvings and present only the last of the successive diagonal halvings in the square, possible for all 7 other situations. Examples for I, J separate, examples for I, J combining.

7. Example showing all A to J halvings in one example.

8. An interesting additional possibility is to produce halves in other directions simultaneously, examples.

Part II: Other Combinable Triangular and Square Halvings

9. Following successive diagonal halvings with single triangles can be made in a square, even including multiple triangles as shown in separate; square; examples of compositions including full base squares.

Part III: Triangular and Square Based Shapes in a Square

10. 7 successive shapes involving triangles sit in a square divided in 8 triangles, 4 different shapes involving squares sit in a square subdivided in 4 squares, non shown directions, symmetries and alternate black/white shapes can be combined; examples of combined shapes involving triangles or squares; of both kinds, example of all shapes combined in one image; examples of two above complex shapes can be combined in different ways. (Worth mentioning that all combinations proceeding from the tangram puzzle are included in this category, but are not addressed in my work).

Examples of Works as Seen in Exhibitions and in Bridges Conferences

Figure 3a provides some simple and complex paintings designed in accordance to described schemes are accompanied in Figure 3b with my participation in 8 Bridges conferences with co-operative works of our "RAM-8 Groep" local artist collective [2 and consecutive years to 2019]. Figure 3c contains 2 sculptures, one project and the image of a street art work now at home that was displayed in town around trees during the rebirth of my early small local RAM artist collective into our present RAM8groep.

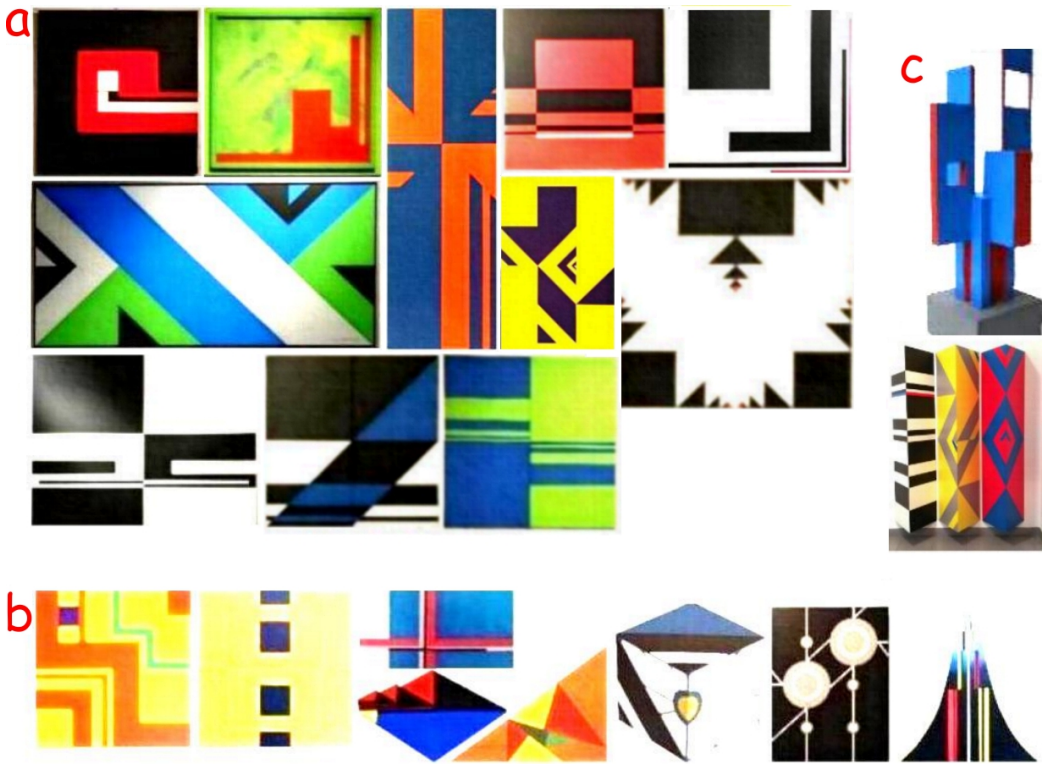

Figure 3: *a. Some of my halving artworks; b. My Bridges works parts of "RAM-8 Groep" co-operative sculptures; c. Project and existing sculptures.*

Conclusion

I hope this multitude of different creations spawned by very simple and inviting means described in this paper might inspire artists and students to decipher them and to join playing. Online searches for fractal aspects, like "simple fractal square" suggested by a reviewer lead to deeper mathematics far beyond my understanding, but I now envision that options for further progress do exist to develop some naming convention characterizing the essence of the numerous instances of the halving processes.

Acknowledgments

I herewith like to thank the members of our joyous RAM-8 Groep artist collective, the happy visitors of the exhibits for their warm support, and the reviewers who creatively provided important improvements.

References

[1] K. Gerstner. *Forms of Color: The Interaction of Visual Elements Paperback.* MIT Press, 1990.
[2] RAM-8 Groep. http://gallery.bridgesmathart.org/exhibitions/2013-bridges-conference/ram-8-groep.
[3] Wikipedia.*Temple of Earth*. https://en.wikipedia.org/wiki/Temple_of_Earth