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A computational approach to generate new modes of spatiality

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Abstract

Questioning new modes of spatiality in design through evolutionary approaches is becoming more significant than ever. Related to the very common use of contemporary evolutionary methodologies, metaphorical relations coming out between design thinking and different structures (open and closed) and also new forms of space in architectural design are now being discussed. We are trying in this research, to query such a relationship between design and poetic language in order to generate new frames of spatiality supported by the syntactic structure of poetic grammar.

Keywords
Evolutionary design, Genetic algorithms, Poetic, Language.

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1. Introduction

Seeking and questioning new frames of spatiality in design through evolutionary design approaches is becoming more significant than ever. Related to the very common use of contemporary evolutionary methodologies, metaphorical relations coming out between design thinking and different structures (open and closed) and also new forms of space in architectural design are now being discussed. We are trying in this research, to query such a relationship between design and poetic language in order to generate new frames of spatiality supported by the syntactic structure of poetic grammar.

Language, as generally assumed, is one of the main forms of human representation. It finds form as common language, body language, machine language, poetic language or some other characterization. Common language is the most used form. Nevertheless, it cannot entirely provide us with the opportunity to unveil a hierarchical formalization of syntax which can be handled through a computational algorithm. Poetic language, however, due to its elaborately chosen vocabulary and wise associations formed between its elements (words), differs from common language. Mukarovsky (1964) claims that poetic language is an independent formation of language rather than a special brand of the standard because of the facts that first different forms of the language (such as narrative, descriptive) may exist side by side in a work of poetry and second that it has some of its own phraseology as well as some grammatical forms. Similarly, Culler (1975) argues that formal devices that are specific to poetry (like poetic line, rhyme) supports the idea of isolating codes, naming the various languages with and among which the text plays. Poetic language also offers a nest of broad meaning within this formalized grammatical structure.

When discussing reflections of poetic language on architecture, haiku is a common type of poetry in discussions of how poetic language can support the idea of creating forms (in an abstract context) in architecture. Introduced to world literature by Japanese poet Matsuo Bashō in the 17th century, traditional Japanese haiku is considered by Antoniades (1992) as a highly powerful sample of semantic density that can attract architects who trace the trails of new spatial experiences. It is important to note that the multiplicity in the semantics of a haiku stems from not only the open-endedness of its meaning but also the formal hierarchy of words and the lack of punctuation marks. In this regard, haiku, known as one of the shortest poem types in world literature, can be said to have an organized formalism. It seems to have the potential to metaphorically be a computational design. Especially the traditional form of haiku consisting of three lines and generally seventeen syllables (five in the first line, seven in the second, and five in the third), demonstrates a defined structure to be examined, evaluated, decoded and computed. Hoffmann (1998) argues that as a new form of "tanka" poem, it has a progressive context and structure where one person can write the three lines with a 5-7-5 structure, and the next person can interpret it by changing some words or by adding a new section with a 7-7 structure. Parallel with this, Henderson (1965) suggests beginning writers to write haiku by connecting non-related subjects through Word association. This openness to intervention and evolution makes haiku form more dynamic and generative.

Related to this view, we propose a technical method to decompose the syntactic structure of a haiku poem and interpret it within design thinking, using basic rules of genetic algorithms, which are, as Whitley (2001) points out, the most recognized form of evolutionary algorithms. Starting from the pioneering studies of John Holland in the 1960s and 1970s, numerous works have made it possible to generate solutions to optimization problems in design by using techniques inspired by nature. In accordance with this generative character of GAs, we examined general properties of haiku poems and new haiku poems are put forth based on these examinations. Next, digital models of the poems are generated as frames related to the predefined structure of haiku poem and finally, they are integrated giving rise to new possibili-

Figure 1. *Encoding and hybridization of symmetric parents (haikus by Dan Doman on the left and by Banea Stefan on the right).*

ties of spatiality.

In this regard, this paper is concerned with how haiku may turn out to be an uncovering layer within the act of designing, by performing as a sort of syntactic generator. Poetic language is claimed to be existing in an unveiling character within the act of designing, since it is re-formed in a computational paradigm by evolutionary techniques, especially by GAs. In the last 20 years, as Koza (1992) highlighted, genetic programming has become an important new sub-area of evolutionary algorithms in design. There is a large body of literature concerning design studies focused on both concepts and rules of genetic algorithms (GAs). Gürer and Çağdaş (2009) claim that built up within nature's existing system principles, these methods are preferred by an ascending number of users through their capability of systematizing design process in holistic evaluation, focusing more on relational and generative details than the other approaches and creating a huge solution domain with high quality. Haiku poems, particularly chosen for this study, have been transmogrified by an algorithmic layout according to the GA rules. Genetic code alternatives that are generated in each level of the process have been utilized to produce new models in architectural design, nominately in searching new spaces. Through the overall con-

Figure 2. *Encoding and hybridization of asymmetric parents (haikus by Nikola Nilic on the left and by Banea Stefan on the right).*

text, this paper discusses the potential of generating new frames of spatiality in design via a particular evolutionary approach, by reforming haiku in GA principles. Processed in an algorithmic flow, poetic syntax turns out to introduce a formal dynamism and a moderate level of basic design complexity.

2. Methodology

In this study, the motivation comes from the plain syntactic configuration of haiku. As a seventeen-syllable poem organized into three lines, traditional Japanese haiku presents a predefined set of syntactic structures. We prefer to investigate haiku poems which are either translations or originally written pieces in English. The primary reason is that English is an inflexional language. Inflexion allows exchanging words between two haiku poems with little or no need for grammar correction. Another reason to study on English haikus is the fact that their syntactic structure has more variations when compared to traditional ones in Japanese.

Use of genetic algorithms in generative design approach makes possible to handle the haiku syntax from an evolutionary perspective. A randomly selected pair of haiku poems is considered as "parents" of future "child" haikus. Initially, syntactic structures of poems are coded individually. Secondly, they are evaluated relatively to each other according to syntactic arrangement in their lines. Later, they are "hybridized" in search of new haiku poems with words "inherited" from both of the parent poems. At the beginning of the coding process, adjectives, nouns and verbs of the first and the second poem are marked by the initial letter of their types, as A, N or V. These initials are treated as "genes" to be replaced by a word of the same type in the other parent. Prepositions and articles are not included in genes so that grammatical structure can be transferred to the "next generation" correctly when word exchange occurs. As the next step, initials are sequentially numerated. Finally, dominance value is attributed to each initial, depending on the length of the lines in the poem. The dominance of an initial is calculated by the division of the maximum number of initials in one line to the total number of initials in its own line.

After coding parents, they are evaluated as a pair in terms of similarity between their syntactic structures. When there is no difference in the number of initials in all of the three lines, the parents are defined as "symmetric" (Figure 1). If there is disparity in the number of initials in at least one line, the parents are defined as "asymmetric" (Figure 2).

3. Design interpretation

3.1. Three-dimensional visualization of Haikus

A specific method is identified in order to not only simulate the syntactic rhythm of haikus three-dimensionally but also make use of child haikus as generators of new frames within the same design language. As a preliminary design exercise, genotype strings of two child haikus produced by hybridization of a randomly selected pair of haikus are physically modeled via the use of this method. Rods are chosen as basic elements to represent haiku words in a three dimensional space organization.

First, word strings of two child haikus are physically modeled as strings of rods whose length are defined by the dominance value of each gene (word). When there is no change in the word type, the next rod (word) is attached to the end of the previous one in the way that both of them can be rotated on parallel planes. Provided that word type alters, the following rod is attached to the former one in the way that they can be rotated on planes perpendicular to the base plane of the former one.

Secondly, rod strings of child haikus are closed, forming frames. At this level, studying on physical models provides the opportunity to acknowledge that relative rotational directions of rods introduce multiple possibilities for enclosure of frames. Once enclosed, configuration of a frame can still be changed by adjusting the moveable joints. However, geometric domain of motion is restricted by the lengths of rods and their rotation planes. When the frame tends to organize itself in a certain formal configuration within the limited movement domain, the

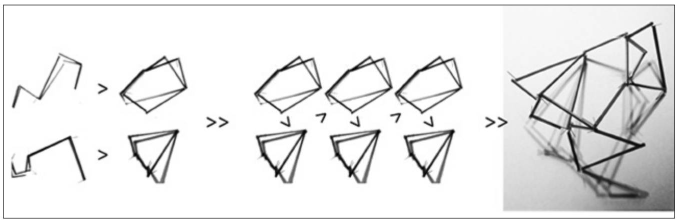

Figure 3. Enclosed and integrated rod strings of child haikus.

joints can be fixed. Thus, among all the possible alternatives, structurally most stable frame configuration is chosen. The joints of a frame may also remain unfixed so that rods can adapt their positions according to their surrounding when the frame becomes part of a structure.

Next, the physical models of the two frames are increased in number by duplication (Figure 3). Then, frames are integrated resulting in triangular or polygonal intersections. In order to observe the motional capacity of the whole structure, none of the joints is fixed. In this way, frames form an interchangeable vertebra for various probabilities of spatiality.

In the method developed for three-dimensional representation of haikus, two types of conversion take place. As already mentioned, dominance value of nouns, adjectives and verbs is used as the parameter determining the length of rods. Hence, numerical distribution of words into lines, in other words, the formal structure of a haiku is converted to dimensional rhythm for the rods of a frame. Secondly, word type alteration in a genotype is used as the parameter to determine planes of rotation for two rods attached to each other. In this way, the syntactic structure of a haiku is converted to mobility for joints of rods.

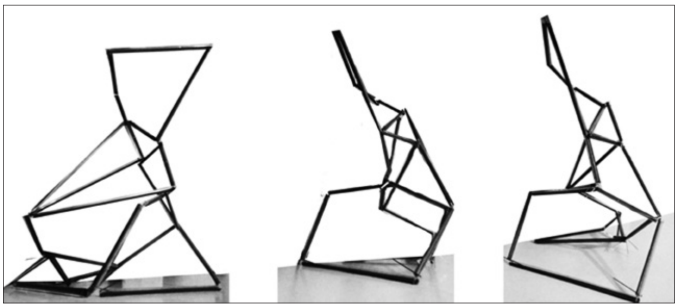

Figure 4. Vertical spatiality of frames.

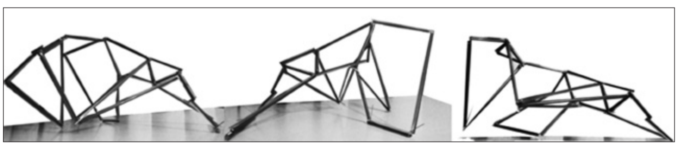

Figure 5. Horizontal spatiality of frames.

Overall, dimensional proportion of rods (1 : 1.5 : 3) and their planes of movement bring about flexibility for the frames to get integrated in different ways and to act dynamically as a whole along different axes. In this regard, formal and syntactic structure of haiku yields diversity in terms of geometric alternatives for integration and motion. However, while unconstrained intersection of frames enriches the set of possible configurations, lack of limitations or rules for integration may give rise to difficulty in controlling and manipulating the spatiality of final forms. Therefore, identification of an integration method is aimed in the further step.

3.2. Three-dimensional integration of Haikus

After the initial physical model search, the scope of the study is extended in order to embody the products of evolutionary process and the duration itself in a more elaborate manner. Having tested the spatial potentials of the three-dimensional visualization technique, a more applicable method is preferred for integration of frames. The current flow of the algorithm can now be regarded as well-defined in terms of feasibility of not only physical but also digital concretization of evolutionary process.

To start with, two poems are randomly selected from the literature of English haiku, haiku 1 by Nikola Nilic and haiku 2 by Banea Stefan [1]. The poems are then encoded according to the method based on certain word types (see section "Method"). After dominance values are attributed to encoded words, code strings of poems are seen to include different numeric values, which cause them to be asymmetric parents (Figure 6). When it is time to hybridize these asymmetric parents, a limited range of crossover is permitted in which only one gene is exchanged between the code strings of parents. As another constraint, crossover is allowed to occur only between the two children haikus just produced in the former step. In other words,

Haiku 1		Common syntactic properties		Haiku 2
moonlight river divides the forest into two nights		Number of nouns: 3 Number of verbs: 1 Number of adjectives: 1		moonlit lake the muzzle of a deer touches water
Gene schema 1		Asymmetry of parents		Gene schema 2
Noun Noun Verb the Noun into Adjective Noun		N — A N N V N ⟷ N N A N — V N		Adjective Noun the Noun of a Noun Verb Noun
Enumerated genes	Dominance values	Crossover schema	Dominance values	Enumerated genes
$N_{1.1}$ $N_{1.2}$ $V_{1.1}$ $N_{1.3}$ $A_{1.1}$ $N_{1.4}$	3 1 1 1 1.5 1.5	$N_{1.1}$ $N_{1.2}$ $V_{1.1}$ $N_{1.3}$ $A_{1.1}$ $N_{1.4}$ $A_{2.1}$ $N_{2.1}$ $N_{2.2}$ $N_{2.3}$ $V_{2.1}$ $N_{2.4}$	1.5 1.5 1.5 1.5 1.5 1.5	$A_{2.1}$ $N_{2.1}$ $N_{2.2}$ $N_{2.3}$ $V_{2.1}$ $N_{2.4}$

Figure 6. *Enumeration and evaluation of a randomly selected pair of haikus.*

slightly altered codes of children haikus become the parent codes of the next generation. The crossover schema in the figure below demonstrates the six possible paths used for gene (word) exchange.

According to the constraints mentioned above, a table (Figure 7) is prepared in which the code strings of two poems evolved along with the gradual progress of hybridization. At the each step of the crossover process, the resulting forms of code strings are named according to their precedence in the evolutionary process and the initial parent poem from which their syntax is inherited. Via the use of the former method (see section "Three-dimensional Visualization of Haikus"), every single code string is physically modeled as enclosed frames of rods. Based on the numerical values in the names, frame models are sequentially aligned in two groups. Next, groups of frames are placed one after another (Figure 8). All of them fixed on a plane along an

Frame 1.1_code	Crossover 1	Frame 2.1_code
$N_{1.1}$ $N_{1.2}$ $V_{1.1}$ $N_{1.3}$ $A_{1.1}$ $N_{1.4}$ 3 1 1 1 1.5 1.5	$N_{1.1}$ $N_{1.2}$ $V_{1.1}$ $N_{1.3}$ $A_{1.1}$ $N_{1.4}$ $A_{2.1}$ $N_{2.1}$ $N_{2.2}$ $N_{2.3}$ $V_{2.1}$ $N_{2.4}$	$A_{2.1}$ $N_{2.1}$ $N_{2.2}$ $N_{2.3}$ $V_{2.1}$ $N_{2.4}$ 1.5 1.5 1.5 1.5 1.5 1.5
Frame 1.2_code	**Crossover 2**	**Frame 2.2_code**
$N_{2.2}$ $N_{1.2}$ $V_{1.1}$ $N_{1.3}$ $A_{1.1}$ $N_{1.4}$ 1.5 1 1 1 1.5 1.5	$N_{2.2}$ $N_{1.2}$ $V_{1.1}$ $N_{1.3}$ $A_{1.1}$ $N_{1.4}$ $A_{2.1}$ $N_{2.1}$ $N_{1.1}$ $N_{2.3}$ $V_{2.1}$ $N_{2.4}$	$A_{2.1}$ $N_{2.1}$ $N_{1.1}$ $N_{2.3}$ $V_{2.1}$ $N_{2.4}$ 1.5 1.5 3 1.5 1.5 1.5
Frame 1.3_code	**Crossover 3**	**Frame 2.3_code**
$N_{2.2}$ $N_{1.2}$ $V_{1.1}$ $N_{2.4}$ $A_{1.1}$ $N_{1.4}$ 1.5 1 1 1.5 1.5 1.5	$N_{2.2}$ $N_{1.2}$ $V_{1.1}$ $N_{2.4}$ $A_{1.1}$ $N_{1.4}$ $A_{2.1}$ $N_{2.1}$ $N_{1.1}$ $N_{2.3}$ $V_{2.1}$ $N_{1.3}$	$A_{2.1}$ $N_{2.1}$ $N_{1.1}$ $N_{2.3}$ $V_{2.1}$ $N_{1.3}$ 1.5 1.5 3 1.5 1.5 1
Frame 1.4_code	**Crossover 4**	**Frame 2.4_code**
$N_{2.2}$ $N_{1.2}$ $V_{2.1}$ $N_{2.4}$ $A_{1.1}$ $N_{1.4}$ 1.5 1 1.5 1.5 1.5 1.5	$N_{2.2}$ $N_{1.2}$ $V_{2.1}$ $N_{2.4}$ $A_{1.1}$ $N_{1.4}$ $A_{2.1}$ $N_{2.1}$ $N_{1.1}$ $N_{2.3}$ $V_{1.1}$ $N_{1.3}$	$A_{2.1}$ $N_{2.1}$ $N_{1.1}$ $N_{2.3}$ $V_{1.1}$ $N_{1.3}$ 1.5 1.5 3 1.5 1 1
Frame 1.5_code	**Crossover 5**	**Frame 2.5_code**
$N_{2.2}$ $N_{1.2}$ $V_{2.1}$ $N_{2.4}$ $A_{2.1}$ $N_{1.4}$ 1.5 1 1.5 1.5 1.5 1.5	$N_{2.2}$ $N_{1.2}$ $V_{2.1}$ $N_{2.4}$ $A_{2.1}$ $N_{1.4}$ $A_{1.1}$ $N_{2.1}$ $N_{1.1}$ $N_{2.3}$ $V_{1.1}$ $N_{1.3}$	$A_{1.1}$ $N_{2.1}$ $N_{1.1}$ $N_{2.3}$ $V_{1.1}$ $N_{1.3}$ 1.5 1.5 3 1.5 1 1
Frame 1.6_code	**Crossover 6**	**Frame 2.6_code**
$N_{2.2}$ $N_{2.1}$ $V_{2.1}$ $N_{2.4}$ $A_{2.1}$ $N_{1.4}$ 1.5 1.5 1.5 1.5 1.5 1.5	$N_{2.2}$ $N_{2.1}$ $V_{2.1}$ $N_{2.4}$ $A_{2.1}$ $N_{1.4}$ $A_{1.1}$ $N_{1.2}$ $N_{1.1}$ $N_{2.3}$ $V_{1.1}$ $N_{1.3}$	$A_{1.1}$ $N_{1.2}$ $N_{1.1}$ $N_{2.3}$ $V_{1.1}$ $N_{1.3}$ 1.5 1 3 1.5 1 1
Frame 1.7_code	**Crossover termination**	**Frame 2.7_code**
$N_{2.2}$ $N_{2.1}$ $V_{2.1}$ $N_{2.4}$ $A_{2.1}$ $N_{2.3}$ 1.5 1.5 1.5 1.5 1.5 1.5	$N_{2.2}$ $N_{2.1}$ $V_{2.1}$ $N_{2.4}$ $A_{2.1}$ $N_{2.3}$ $A_{1.1}$ $N_{1.2}$ $N_{1.1}$ $N_{1.4}$ $V_{1.1}$ $N_{1.3}$	$A_{1.1}$ $N_{1.2}$ $N_{1.1}$ $N_{1.4}$ $V_{1.1}$ $N_{1.3}$ 1.5 1 3 1.5 1 1

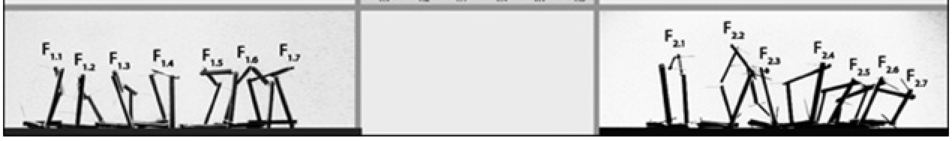

Figure 7. *Formal evolution of frames (phenotypes).*

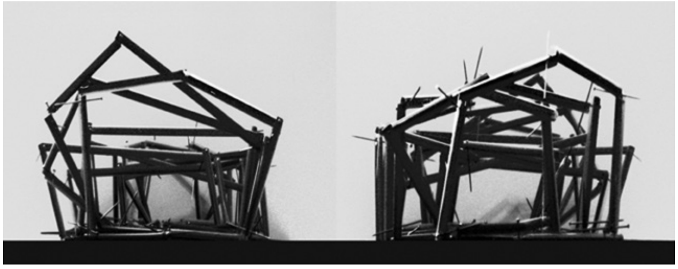

Figure 8. *Perspective view, front and back elevations of the physical models of frames.*

approximately linear axis, frames are seen to bring about a formal rhythm which is visible both in the elevation and perspective views.

As for the digital representation phase, together with the Grasshopper plug-in, Rhinoceros 3D modeling software is preferred to use for two main reasons. First, Rhinoceros 3D facilitates ease of modeling non-uniform rational B-spline (NURBS) surfaces, making it possible to connect the frames by forming quadrilateral surfaces instead of triangulation. Secondly, Grasshopper interface provides the chance to represent and manipulate dynamic forms in ease.

The process of digitalization begins with the definition of rods of frames as connected lines which can be rotated relatively to one another. After all the six rods are represented as six lines in equal lengths to their physical versions, the open endpoint of the first line and the last line are required to intersect so that a frame can be formed. However, multiple axes for relative rotations and three different values of line length make it almost impossible to close frames by trying to manually fix the angular positions of lines. Therefore, the 'Galapagos' component, which is the evolutionary solver of Grasshopper, is utilized to be able to adjust the positions of every group of six lines. In order to function the 'Galapagos' component, all of the sliders determining the relative rotational motion of frames are identified as 'Genome'. The distance between the open endpoints of the first line and the last line is measured by the 'Distance' component. Connecting the distance value to the 'Fitness' part, the 'Galapagos' component becomes ready to function. As the distance value has to be equal to zero for frame formation, minimization of the distance is defined as the target of the evolutionary process. Genetic algorithm is run by the 'Galapagos' component to minimize the shortest distance between the two endpoints up to the threshold value of zero. After a certain number of generations are produced, endpoints finally intersect in precision at the possible highest level. If not 0.000000, groups of lines are closed as frames at a distance of around 0.001112 mm between the two endpoints.

In this way, lines update the coordinates of their endpoints in the way that they can be stabilized, forming a rigid frame. At this point, it is important to underline that groups of lines have different tendencies to organize their positions when the evolutionary solver is run at varying initial configurations. This demonstrates multiple possibilities for enclosure of frames and thereby the final configuration of the frame group. When all of the frames are stabilized in desired forms by the help of the evolutionary solver, they may also be claimed to reach one of the true poses in terms of their self-standing capability. To benefit from the opportunities of digital modeling interface, the rigid frames are organized in a dynamic way in all of the x, y and z axes, forming a vertebra of curvilinear tube. As the final step, the endpoints of all of the lines are joined to the nearest endpoint of both the previous and the next frame. This method results in the formation of quadrilateral surfaces at a minimum level of curvilinearity since there is no need for triangulation as all the frames possess the same number of edge points. Viewed by different perspectives (Figure 9, Figure 10), the final form presents a non-uniform volume which has a moderate level of formal complexity.

Compared to standard flow of genetic algorithm, the applied crossover technique may be regarded as a small-scale manipulation process. However, such a decelerated evolution provides us with two crucial opportunities. First, reduced rate of differentiation per iteration gives the chance to have a better understanding of the evolution occurring in both phenotypes (frames) and genotypes (poems). Second, narrowness of the gene pool results in a

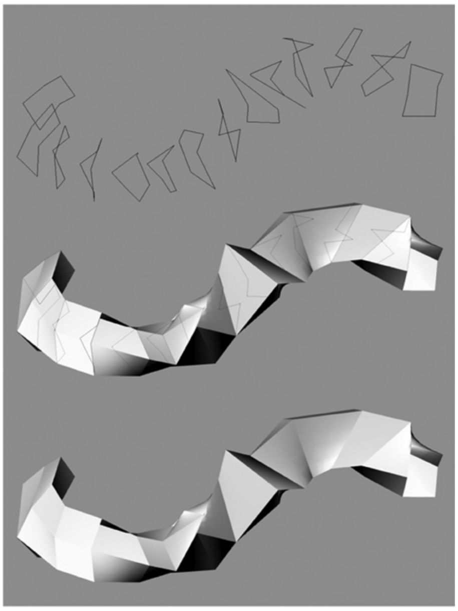

Figure 9. Curvilinear volume formation through frames.

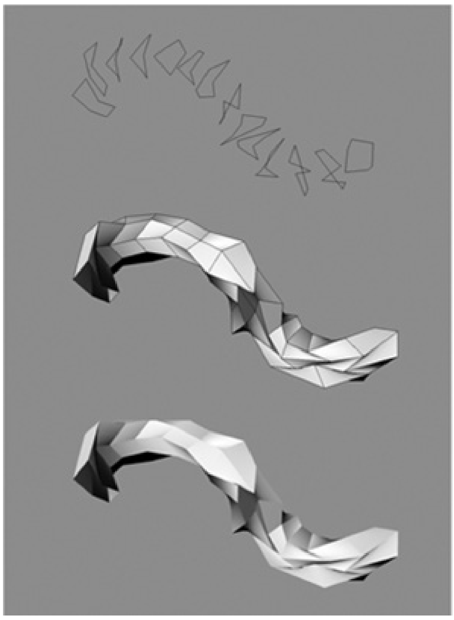

Figure 10. Curvilinear tube viewed from different perspectives.

three-dimensional formal gradient along the sequential array of phenotypes. In addition, it also gives rise to a gradient pattern in semantics of the selected haiku poems, namely genotypes.

Overall, the method can be regarded as a demonstration of possible degrees of genetic alteration at a time, ranging between the minimum and the maximum thresholds of evolution. The initial forms of selected poems and their three-dimensional representations as frames exhibit the minimum amount of evolution, that is, the case when no hybridization occurs. As for the final genotypic and phenotypic results after evolution, all of the genes in the code strings of two parent poems are seen to have been interchanged, which demonstrates the theoretically maximum amount of evolution that may take place between only one pair of parents.

When the crossover is terminated after six iterations, numeric values in the code strings of both poems are totally exchanged (Figure 7). Due to the dissimilarity of the two syntactic structures and choices for gene exchange paths, the order of dominance values in the final code strings differ from the very first sequence of the other parent poem. However, when a certain configuration of frame is presented, it sometimes becomes impossible to ensure on which level of the crossover it was produced. For instance, it is not possible to distinguish frame 1.6 from frame 2.1 by just comparing their phenotypic appearances since both of them have exactly the same sequence of dominance values.

At this point, genotypes, semantically evolved forms of the two haiku poems make it possible to ensure the level of hybridization of which a frame

Haiku 1	Crossover schema	Haiku 2
moonlight river divides the forest into two nights	moonlight river divides the forest into two nights moonlit lake the muzzle of a deer touches water	moonlit lake the muzzle of a deer touches water
Haiku 1.1	Crossover 1	Haiku 2.1
moonlight river divides the forest into two nights	moonlight river divides the forest into two nights moonlit lake the muzzle of a deer touches water	moonlit lake the muzzle of a deer touches water
Haiku 1.2	Crossover 2	Haiku 2.2
muzzle river divides the forest into two nights	muzzle river divides the forest into two nights moonlit lake the moonlight of a deer touches water	moonlit lake the moonlight of a deer touches water
Haiku 1.3	Crossover 3	Haiku 2.3
muzzle river divides the water into two nights	muzzle river divides the water into two nights moonlit lake the moonlight of a deer touches forest	moonlit lake the moonlight of a deer touches forest
Haiku 1.4	Crossover 4	Haiku 2.4
muzzle river touches the water into two nights	muzzle river touches the water into two nights moonlit lake the moonlight of a deer divides forest	moonlit lake the moonlight of a deer divides forest
Haiku 1.5	Crossover 5	Haiku 2.5
muzzle river touches the water into moonlit nights	muzzle river touches the water into moonlit nights two lake the moonlight of a deer divides forest	two lakes* the moonlight of a deer divides forest
Haiku 1.6	Crossover 6	Haiku 2.6
muzzle lake touches the water into moonlit nights	muzzle lake touches the water into moonlit nights two river the moonlight of a deer divides forest	two rivers* the moonlight of a deer divides forest
Haiku 1.7	Crossover termination	Haiku 2.7
muzzle lake touches the water into moonlit deer	muzzle moonlight touches the water into moonlit deer two river the moonlight of a nights divides forest	two rivers* the moonlight of a night* divides forest
Haiku 2		Haiku 1
moonlit lake the muzzle of a deer touches water		moonlight river divides the forest into two nights

Figure 11. Semantic evolution of haikus (genotypes).

came out. As the encoded vocabularies of the two poems are completely distinct, none of the members of new haiku offspring is identical to one another. Yielding different meanings, each haiku exhibits a unique genotype for each phenotypic representation. In addition, by means of comparison between the vocabularies of an evolved haiku and its initial form, the number of exchanged words can easily be detected. Since only one word is exchanged at each level of hybridization, the number of new words in a haiku is equal to the number of genetic iterations that came along so far (Figure 11).

4. Concluding remarks

Presumed as an organized structure, poetry is taken as one of the poses for uncovering formalism in the language and then in design. The idea of taking GA's techniques to transfer the syntactic information of haiku poems to a computational domain in order to create codes for basic spatial configurations is discussed. Plain configuration of haiku which is a seventeen-syllable poem organized into three lines presents a predefined set of syntactic structures. The claim is that the unfolding of the existing formalism in haiku structure and the computation of new frames spatiality in architectural design benefit from genetic algorithms.

When compared to general flow of GA's, a specific contextual method with a simplified form of crossover technique has been defined to both compute and model the syntactic rhythm of haikus. While decoding haiku poems, using haikus as genotypes rather than binary genotypes prevented to lose the very connection with logic and semantics in poems. Haikus standing for genotypes represent not only the content but also the quantity of evolution. Here, it seems possible to indicate that haikus as genotypes have superiority over binary genotypes that are most commonly used in computational applications of genetic algorithm. As a numerical representation consisting of 0s and 1s, binary coding cannot go beyond the degree up to which the code strings of dominance values contribute to the clarification of the 'blind' process of evolution. Haikus, however, point out where a phenotype can be positioned as a crystallization point within the uncontrolled duration of evolution. Hence, such an approach not only seeks for a way to deepen the understanding of evolutionary design process but also offers the chance to gain control over the genotypic by-products of the duration.

Spatial configurations that are based on a specific three-dimensionally modeling technique are just one way of interpreting decoded data of the poems. Alternatives can be produced by varying frame associations. Both the generative character of GA's techniques and humble but dynamic structure of haiku also support this formal diversification. Beside this, proposed technique specifically provides multiple instances of spatial continuity within a transition of different qualities. Three dimensional sections ensure organization of surfaces that make form and space.

In a broad sense, the contribution of this unique study can be summarized as a syntactical translation of a very determined type of poetic language to the basic form generation domain in computational design terms. At this juncture, problems regarding contextualization of the concepts, rules and methods of a general computational technique have been questioned and an updated perspective for the use of GAs in early stages of design has been provided. By providing this, the study also shows a practical example and local remarks for the general idea of integrating evolutionary design tecniques into architectural design education at a larger scale.

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[1] http://www.iyume.com/haiku/haikuex.html (accessed on 11.04.2013)