The sustainable cybernetics of formal language in Islamic cities

O. Alrawi
Future University in Egypt, Egypt

Abstract

Sustainable development is not a process to reach an end state but rather an ongoing process. Sustainability is the self-evident term for the dynamic equilibrium between man and nature and for the co-evolution of both within the Gaia mega-system. The complementary system in nature in its profusion of formal language is expressed in infinite multidimensional patterns. Approaches to form generation that operates without employing a priori categories of form have required a new definition of the concept of form. Here the distinction between form and formation becomes significant. If we study architecture as the history of meaningful form, we will discover man, nature and we will know how God gave us the tools for real creativity. Creativity involves the development of original, imaginative ideas, usually for a particular purpose and can be situated in both cognitive and social domains. For the purpose of cultural heritage presence, we shall be dealing with the cybernetics theory, especially the second-order cybernetics that can contribute to symbiotic dialogues between societies, at a side, and art, architecture and urbanism on the other side. In this regard, we shall try to reach an understanding for the sustainable creative process considering changes in human faculties in Islamic cities. This paper tries to discover the ability of historic cities to become a source of inspiration which enables a society to innovate by re-interpreting the past, overcoming the dichotomies resulting from a single-minded pursuit of a narrow vision of progress. It will also try to identify the way in which a creative exploration and a careful evolution of historic cities can give birth to cultural continuity that can re-establish an organic link with the past, for the sake of re-integrating human wholeness and for motivations that goes beyond the rationality of these cities.
Keywords: cybernetics, cultural heritage, Arabic-Islamic cities, architecture.

1 Introduction

Cybernetics is coming to have across a wide variety of subject-matters including engineering, biology, physiology, medicine, psychology, psychiatry, anthropology, sociology, economics, education and business management [1]. In this research we will try to study the human thinking behind the formal language in the art and architecture of Islamic cities at that time span within all its aspects of social limitations to increase the understanding of the development of design thinking. This process will help to improve computer implementation of architectural design, considering the process-oriented creative activity.

One of the consequences of this implementation is the blurring of some of the traditional distinctions between the work of art and architecture and the system which creates this work. It is important to know how far cybernetics has really been instrumental in bringing this about and how far other major factors that have been involved are impossible to estimate. It could be argued that pure science and art are in any case not as incompatible as they are often assumed to be and that the same processes are involved in both, and that creative activity in all fields may be essentially the same. Nevertheless there could be a particularly close relationship between cybernetic model-building and artistic creation in that the cybernetician as a modeler (at least in hardware) is creating as well as discovering, and is expressing his ideas in concrete terms and, in doing so, has a flexible choice of methods and materials which to some extent allows him to express his own preferences and individuality [2]. Cybernetics and sustainability are two major characters of our cosmological system. Cybernetics deals with governing laws in animals and plantation, while sustainability deals with the way life continues on earth with a certain degree of equilibrium. Formal language is the dynamic result of a responsive and generative process dealing with the existential identity of arts and architecture (fig. 1). The architecture of style, or perhaps we should say, monumental architecture, is more-over, a manifestation of permanence and change, and perhaps it is also a "timeless" response to the set
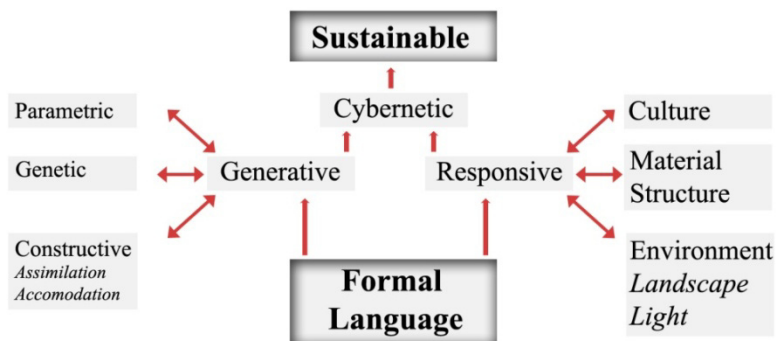

Figure 1: The relationships that are necessary to comprise a different use of the language of formation.

of problems of the place, which would justify the continual and ever-renewed use of style over the passage of the centuries [7].

2   Cybernetics, architecture and the constructivist theory

Recognition that architecture was located in an *interactive system* rather than residing in a material object provided a discipline as central to an *art of interactivity* as anatomy and perspective had been to the renaissance vision. Moving away from the notion of architecture as constituted in autonomous objects, it can be redefined as a cybernetic system comprised of a network of feedback loops. Architecture is one member in a family of interconnected feedback loops in the cultural sphere, and culture itself is just one set of processes in a larger network of social relations. In this way, we could integrate cybernetics into aesthetics to theorize the relationship between architecture and society in terms of the interactive flow of information and behavior through a network of interconnected processes and systems.

Vision of cybernetic architecture could be founded in the concepts of process, behavior, and system. When architecture is understood as a form of behavior, software predominates over hardware in the creative sphere. Process replaces product in importance, just as system supersedes structure.

Factors essential to life and organic development, consists consciousness that conjoined past, present, and future, dissolving the diachronic appearance of sequential time, and providing instead a unified experience of the synchronic relatedness of continuous change. In this light, the architectural language of old Islamic cities can be interpreted as models in which potential forms could creatively evolve, revealing the multiple stages of their nature (as in the growth of a biological organism), over the duration of their changing compositional states. We could conceive the infinite combination of these compositional transformations as comprising an aesthetic unity, a Meta-consciousness, including all possible states in the past, present, and future [5]. History must be brought up to date by making a leap out of the past and into the future. The problem of creating forms for the future can be postponed no longer [6].

While cybernetics offered a flexible theory that was adaptable to a wide range of applications in the sciences, social sciences, and humanities, it might be argued that in the absence of a complementary aesthetic context, there would have been no common ground for the accommodation of cybernetics to architectural concerns.

Cybernetics has provided us with a starting point from which observations of the world can be made. There are other points of departure: the need to find patterns of connections in events and sets of objects; the need to make ideas solid, but interfusable; an awareness of change as fundamental to our experience of reality; the intention to make movement a subtle but essential part of an artifact. In this context, the artist explicitly states that cybernetics provided a conceptual framework for interpreting phenomena artistically. The recognition of "change" as fundamental to "the experience of reality" is an idea akin to

Bergson's concept of *durée*. The "need to make ideas solid but interfusable" suggests the modular, concrete aesthetic of constructivism [5].

   Constructivism is a theory of knowledge (epistemology) that argues that humans generate knowledge and meaning from an interaction between their experience and their ideas. Through processes of accommodation and assimilation, individuals construct new knowledge from their experience (fig. 2).
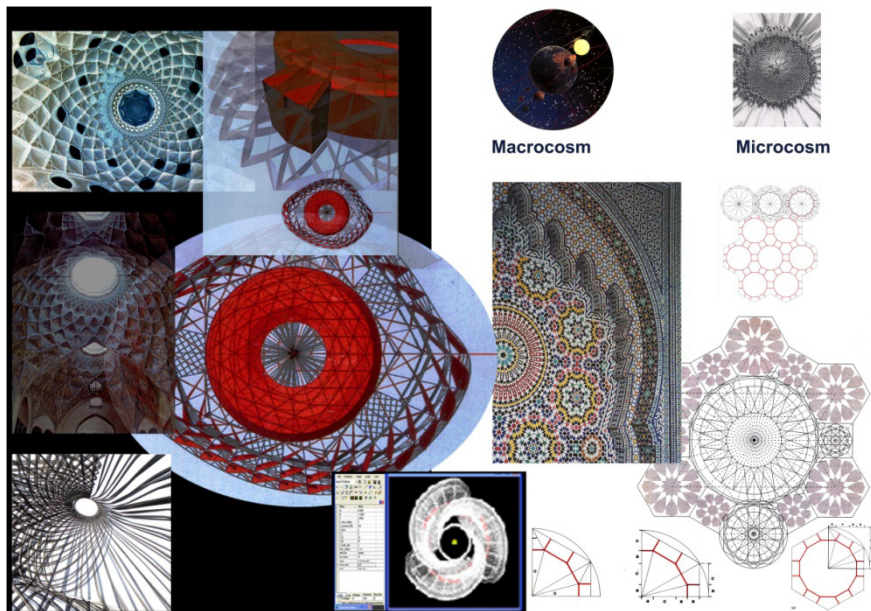

Figure 2:   A skillful dynamic mechanism is built by means of the basic two-dimensional visual elements of line, color, light and dark values which actually sets the geometrical patterns in motion.

3   The origins of formal language in Islamic cities

The history of cities could be interpreted as the clash between geometry (an invariable of dictatorial or bureaucratic power) and free forms (which are congenial to human life). It is argued that cybernetics is related to art in three ways: it may be used by the scientist in studying art, it may be used by the artist in creating works of art-and may have been one of the influences behind the development of the idea of machines as works of art and machines for creating art, as well as the increasingly process oriented nature of contemporary art-and finally cybernetics may itself be regarded in certain respects as an art form in its own right [1].   We will at first step answer the question of the originality and uniqueness of Islamic art and architecture by raising the problem of its formation. Problems of an art created in the unique historical circumstances of Islamic art cannot be explained in purely formal or purely art historical terms. It

has to be seen in what would have been called its ecological setting that is in a certain relation-ship between man and his surroundings.

3.1 Formal language as a responsive implementation

This is a sort of implementation that means building the world of life in accordance with an understanding of place. In other words, implementation is tantamount to translating the landscape that has been understood into architecture, so that the use of place can be attained, a natural landscape can be transformed into a cultural landscape. The implementation of phenomenological understanding is not limited to individual buildings or settlements, but concerns also the linguistic code that they share. The linguistic form is a presupposition to every planed world, and it provides concrete form of the way in which architecture exists (fig. 3).
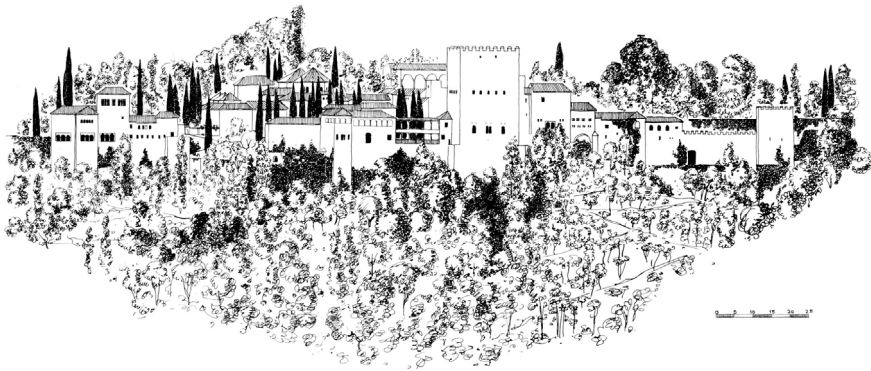

Figure 3:   *Alhambra, Granada (14th century).* Manifestation of the human presence that implies a typical earth-sky responsive relationship.

In stating that classical language took its origins from the solar space of the South, we mean that it belongs to that space and is not easily transferred to other places, since it is proper to the temperate Mediterranean centre, but can in any case mediate its clarification to the surrounding worlds. And here we are primarily referring to the torrid and desert strip to the south and the east, and to the dark and chilly regions to the north and west. Both these regions, in fact, by principle reject the classical vision and the plasticity of its presence, while absorbing it in different ways, dematerializing its form. In the desert architecture of Islam, this occurs through the light that transforms every substance into interweaving of irradiating geometric forms, so that the positive classical agglomeration becomes a negative void with a reversal that is expressed, for instance, in the so-called muqarnas (fig. 7) [7].

The geometrical constitution resulting from the pure mathematics of spatial-temporal shapes in general forms the primary character of the generic concept of geometry and confers on geometrical arts (fig. 4). This means that the category of imaging geometry comprises two types, two dimensional and three-

Royal Bath
Alhambra, Granada (14th century).

Design Process and Origins
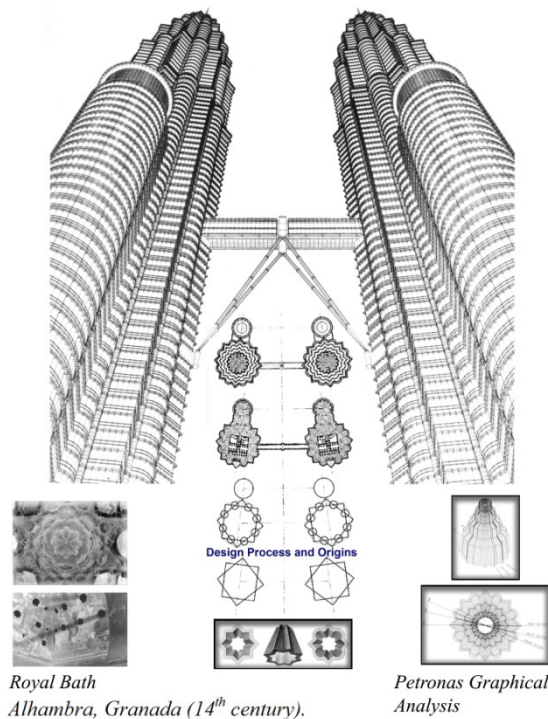
Petronas Graphical
Analysis

Figure 4:   The Petronas Twin Towers, in Kuala Lumpur, Malaysia, 1997 –
Architect César Pelli. Architecture that can afford time changes
and can maintain a responsive relationship that is seeking time-less
art and architecture.

dimensional imaging geometrics (fig. 5). The first is a metaphor of space, and
the others are metaphors of things or bodies, both working exactly to the same
rules. They simply constitutes particular cases with particular structures and
contents of the same generic aesthetic proposition [8].

This is not setting for a detailed account of the Islamic form, but we do wish
to mention. at the very least. the way in which the geometry of light – which is
executed in a neutral stucco on the interior of the ceiling-is coloured when it
encounters the earth, thus acquiring a "floral" imprint. The Islamic
dematerialization communicates an interpretation of "earth lines" in an endless
extension, in the implementation of which man plays no role whatever, as is
confirmed for that matter by the iconoclastic prohibition. Instead, it is the sky
that is portrayed, not so much as a vault, but rather as light, in accordance with
the statement of the Koran: "God is light of heaven and earth" [7].

In the middle ages, there exists and for the first time, the two principles of
light and perspective through the theories of Ibn al-Haytham (965 in Basra, Iraq–
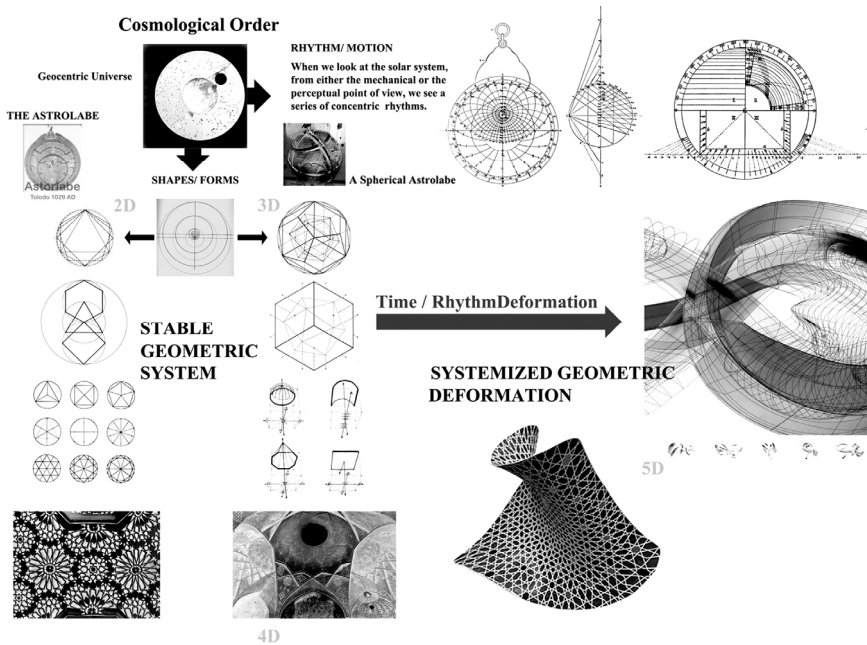c. 1040 in Cairo Egypt, was a prominent scientist and polymath from the

Figure 5:   Cosmic rules are timeless, and are a unique source of learning design ideologies that contains diversity and adaptability and also has the facility of responsiveness/feedback.

'Golden Age' of Muslim civilization) in an amazing modern terms of phenomenology and psychophysics, and as a primary cognitive experience in general. This corpus provides a scientifically important proposition about the physical process of seeing, thanks to the activities of both light and colour:

> "The sight perceives the light and the colour existing in the surface of the contemplated object, thanks to the shape that expands from the light and the colour existing from the surface of this object through an intermediary diaphanous body between the sight and the object. The vision necessarily perceives all objects by means of supposed straight lines that extend themselves between the object and the central point of sight".

Ibn al-Haytham's theory of vision does not limit itself to the strictly scientific realm but deals with deeply aesthetic questions and considerations, taking into account as major objects of analysis the double concept of beauty and ugliness and the observer's experience of it.

Ibn al-Haytham recognizes beauty and ugliness as objective and visible facts which all objects or corporeal beings display in varying degrees, among other objective facts that define them generally and that he calls in Arabic 'al-maani al mubsara', 'perceptual meanings'.

Things are variously beautiful according to two principles, says Ibn al-Haytham. The first is that the generic visual properties or concepts-those he

listed and counted in determining the corporal constitution of things-contain intrinsic beauty *per se*.

The second principle is the modulator or the shaping principles of this beauty *per se*, conveyed by t6he generic visual concepts into particular, single beauty, thus a measureable, quantifiable and therefore classifiable beauty. This modulation process of the beautiful operates through the specific combination of one, some, or all of these generic visual concepts with the particular, proper visual concepts owned by the form of each thing or each type of thing. So that finally the specified object offers to the sight and perception a particular category and a particular quality of beauty [8].

The concept of thing leads to a more satisfactory language. Everything has a name: "It is order" says Heidegger that first gives things their being. And it is language then that talks to us of things, of relationships among and between things, and of the world as a whole of totality [7].

3.2 Formal language as a generative beauty

According to Ibn al-Haytham theory, the beauty that clearly exists in all things must be grasped by the individual in its full *complexity*, *variation* and *subtlety*, as and when his perceptive ability matures, improves and sharpens with practice and use. Thus it concerns a complex process of visual perception that appeals to the combination of sensory grasp with a form of understanding derived from the imaginative faculties and other modes of intuitive or *pre-logical knowledge* [gonzalez].

According to Ibn al-Haytham's conception of observable beauty, defined in terms of objective visual qualities, we could refer to a text where he expounds the basic conditions required for human beauty:

"Proportionality (tanasub) alone may produce beauty, provided that the organs are not in themselves ugly, though not perfect in their beauty. Thus when a form combines the beauty of the shapes of all its parts and the beauty of their magnitudes and their composition and the proportionality of parts in regard to shape, size, position and all the other properties required by proportionality, and moreover, when the organs are proportionate to the shape and size of the face as a whole-that is perfect beauty. A form that has some these properties to the exclusion of others will be considered beautiful in accordance with what it has of the beautiful properties".

Among the particular visual properties responsible for the high degree of beauty in an object, there appear those of order and symmetry combined with related principles like proportional correspondence and harmony, fig. 6. These attributes and qualities correspond to an objective structure of beauty consciously perceived and situated in real-life experience.

4 Formal language and stylistic architecture

Stylistic architecture, is mobile, and is therefore characterized by a presence "everywhere", even though it does take into consideration a certain degree of
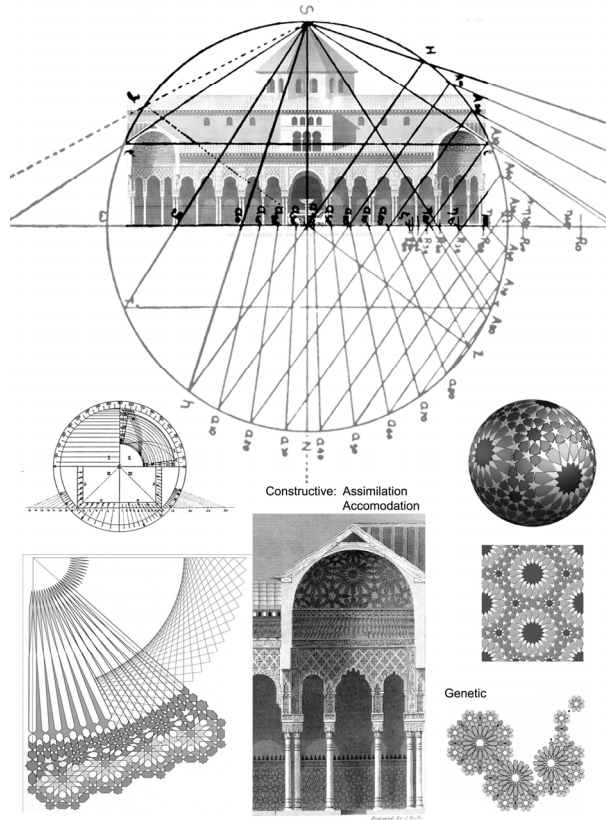
Figure 6:   *Alhambra, Granada (14th century).* Form generation is derived from an internal genetic coding that replaces traditional interaction with the form itself. The processes of variation, recombination and selection on the basis of fitness and *proportionality* underlying most processes of evolution and adaptation.

local adaptation, though this does not result in a loss of its basic significance. Style in fact, is an image of the life as a generally valid phenomenon, and is therefore valid everywhere or at least within the context of a given cultural context. This is, in any case less immediate and concrete than the vital and deep-rooted presence of the tradition of building. A style, then, is well suited to expressing various theories on the way in which the world presents itself.

As a formal language, style allows composition with a series of unfailingly new manifestations. These require homogenous space in which to organize their component parts. The danger in developing a style consists of a growing abstraction, and in a loss of proximity as had become evident, when composition degenerated into an atomistic combination of elements [7].

Space geometry possesses an objective, intrinsic and permanent aesthetic movement that transforms itself, in the viewer's eye, into an experimental and circumstantial movement, fig. 7. Therefore we can assert that it is doubly kinetic, namely objectively and empirically kinetic and that ontologically it has a double existence, both objective and subjective [8].

The combination of *interactivity*, *transformability* and *parametrically* controlled perturbations that generate discrete structural variations within design formation processes is an emerging characteristic *phenomenon* of digital design.

It very obvious from the analysis in fig. 7, that the formal language in Islamic Architecture has the internal generative capabilities of adaptability and change, continuity, proximity and connectivity that is required in parametric systems and which are becoming cornerstone in the more complex performative digital environment, and that also includes the body of the theoretical concepts related to parametric formations.
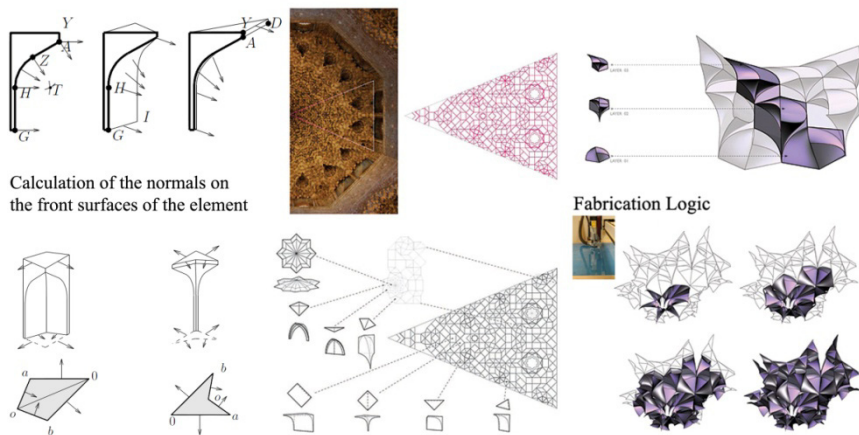

Figure 7:   *Alhambra, Granada (14th century).* Processes of generation are synthesized as a kind of accelerated motion, adding in formation integrally to the construction.

5 The development of formal language: the need for new conceptual vocabularies

These concepts could be moving architecture from traditional typological design towards topology-based design – from form-based processes towards process-based design – are developing new roles for the human designer in interaction with digital technologies and resources. The new relations between digital form and digital processes are contributing today to the emergence of new conceptual vocabulary, and domain knowledge. It characterizes what might legitimately be

considered the early formative stages of a paradigm shift. If digital design knowledge constitutes among other things a new set of conceptualizations, including ideas related to the meaning of form, the nature of functional and formal knowledge, and the models of generative processes, there is a need for an encompassing theory of digital design pedagogy that accommodates this modified knowledge base.

The traditional role of the 'the designer as a user' is extended to 'the designer as a tool builder'. A tool builder can define his own generative components and define their transformational behavior.

Creativity is simply transferred from the designing of a single design to the design of rules. The same intelligence, imagination, guesswork, and intuition that goes into the former is required for the latter

The generative model is the design of, and interaction with, complex mechanisms that deal with the emergence of forms deriving from generative rules, relations and principles. Shapes and forms are considered to be a result of pre-formulated generative processes. Interaction has a major priority in this model. In order to employ generative techniques in design, there is a need for an interactive module that provides control and choices for the designer to guide the selection of desired solutions (fig. 8).

Currently there is a rich theoretical body of research-related applications of generative models. Two main distinct current sub-approaches are shape grammars and evolutionary models. Shape grammars are mathematical expressions for computational mechanisms that drive shape generation processes through transformational rules. Evolutionary form-generation techniques are based on evolutionary models of natural generation that can be applied to generative processes in design.
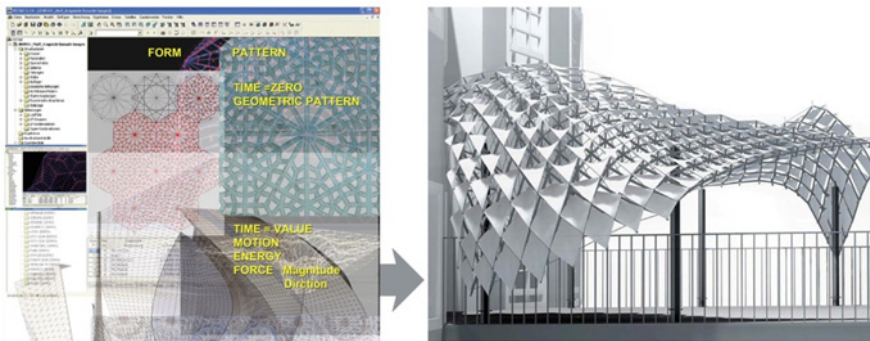

Figure 8:   Islamic geometrical patterns that have the capability of transformation to structures. Structuring is the process whereby parts-to-whole relationship develops between the elements of architecture. Mathematical/geometric: syntactic and formal logic which is necessary for digital tectonics.

6   Conclusion

Cybernetic serendipity deals with possibilities rather than achievements, and in this sense it is prematurely optimistic. Design lives within two fundamental stages, the creative and the evolutionary. The first is that of producing the idea: this approach is built activating a logical jump between the existing and possible worlds that represent our wishes and thoughts. A design idea is the identification of a set of possibilities that goes beyond specific solutions but identifies the sense of attainable quality. The second is the evolutionary stage, that of the development of the idea. This process runs inside paths of refinement and increases in complexity of the projects.

The exploration of new conceptual vocabularies may require different stages of exploration. This orientation can be achieved only by freeing designers from expectations related to conventionalized design approach. Formal languages are created by transforming the spatial relations underlying grammars for existing languages. In other words, a known style is first analyzed by inferring a grammar for it, the rules of the grammar are transformed, and then the transformed rules become the basis for a new grammar and style.

Histories serve as a store of experience, available for use in similar situations in future designs. Histories are also a rich source of material for learning. Previous stored cases can be used as a basis for abstraction or analogy, while cases with common similarities may help synthesize generalized knowledge. Other histories related to the design may help gather observations applicable to future architectural designs in Islamic cities and activate the creative potentiality of traditional urbanization process especially in the age of globalization.

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