

Harmonious Architecture and Kinetic Linear Energy

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BACKGROUND

Several authors have affirmed that human bodies, nature and manmade environment are often governed by the same laws of thermodynamics that regulate natural phenomena, such as growth and expansion. Growth and expansion are also considered as materialization of the life itself, if we grasp them as mere manifestation of being alive. However from the very beginning that ancient Greek language have appeared, we can find out that *ζοή* (life, existence) is a very different word and term from *bios* (a unique way that human being behave and perform whilst showing that they alive). When human bios shows full performance of body and mind in order to guarantee healthy existence for both, then, the material body exists and begins infinite and often complex movements around along energetic pathways/lines, forming a complex web. Thus, purposely created built environment by performing human bodies, behaving according to especially triggered emotions, may often conceal such a large quantity of energy that, lines of moving bodies can even define *explosions*. They may be eventually suggest radical alterations of their natural and non-natural surroundings.

Long-ago lines/pathways still hiding in urban context do not only have an impact to human beings' behaviours, but, they may also dictate definite movement of bodies, often articulated by unique rituals. These particular rituals/practices were predominantly part of religious and worshipping practices in many temples in Ancient Greek and Roman times. And in recent times, many artists, like dancers, for instance, found exceptional inspiration in and around temples venerating gods and goddesses who had professed and carried out significant energetic deeds. Performance of rituals along long pathways, such along the famous Panathenae parade in Athens, include a great variety of actions of bodies in movement, at times so close to each other that, body heat could be felt at very close distance. Parades along these energetic lines have left clear signs into modern landscapes in cities ; mystical performance paths filled by unique arrays of manifestations of bio-rituals still influence urban sprawl and/or regeneration in many districts of modern cities with long historical past.

Pathways crossing landscapes stay alive as long as performing bodies in movement act together to accomplish either rituals of everyday life or unique spiritual and

harmonious acts of devotion towards powerful gods who represent natural elements, such as fire, air, etc. Still today the lines that cross ancient and modern landscapes linger as powerful elements to dictate human interactions and further urban growth. Hence lines defined by geometrical conventions often perform as germinating elements that are strictly controlled by human performances ; these powerful indicators of life and bios are capable to act in synchrony to encourage further generation of natural and manmade environments. The long spiritual existence of these pathways still influences human beings' emotions and motivates them to perform rational and harmonious walks ; bodies seem to dance and prescribe new extended spatiality in a rational way. Bodies simply follow preferential lines along which spirituality and spatiality manage to blend in an eternal drama of actions and interactions between human beings and surrounding environments in evolution. Humans who are motivated by emotions triggered by these environments become so powerfully rational that they manage to act in such an intensive manner which favours spiralling creativity ; everyday life rituals trigger truthful art and architecture inside long-lasting evolving spatial realities.

ETERNAL PLAY OF LINES FORMING INDEXICAL PATHS OF HUMAN BIO-RITUALS

As an architect and spatial designer, the author has carried out research on human behaviours in a variety of environments for many years; she has come to conclusions which show that every single person on Earth can act as an artist or performer who is capable to orchestrate cosmic movements of pathlines ; these everlasting lines are capable to 'explode' into cosmic fractal geometries interacting with both natural and built environments. This is proved to be the accurate and uninterrupted way of procreating three-dimensional architectural emergences in harmony with human actions/performances/rituals. At first a human being is transformed unconsciously into an actor, a performer and a doer. Artists or doers have been always inspired by geometrical shapes and forms. However it is not always necessary to be a mathematician in order to be a performer inside a drama of lines ; mathematics is intellectual and verbal, whilst art and architecture may be non-verbal and made of emotions. Whilst performing, artists/doers can accept powerful and complex geometrical models which are capable to persuade them that spaces can be different as geometrical expressions of diverse human attitudes. Spatial expressions are created by selected and preferential geometries ; space for its doers becomes

their only real fascination. Guillaume Apollinaire suggests that "geometry is to the plastic arts what grammar is to the art of the writer"¹. Therefore, complex indexical geometries, such as grids formed by intersecting dynamic lines, may represent a performer's *grammar* of movements along strictly prescribed pathways. Every human being at some part of or in most of their life can be fascinated by geometries formed by generating lines in a play of mystic forces capable of procreating primordial cell-forms to develop into complexity at the end. A form becomes reality whenever a point/doer moves along a bio-ritual pathline to define multiple performing processes ; these processes most of the times are defined by bodily rituals dictated by exploratory needs of both our conscious and unconscious motivations activated by stimulating and inspirational surroundings.

Especially in pictorial spaces, line considered as *proforma* (an occurrence before forming an explicit form) has been constantly thought to be a powerful procreating element in arts. Nonetheless performing and highly interactive spaces are made of powerful performing lines that they have been generously manipulated by architects in order to generate designs. Generating lines in building designs are often mutations of real flows of lines of

human movements. They often coincide with lines along boundaries ; likewise other impact lines colliding with these borderlines explode again in many directions and angles to form three-dimensional volumes, thus forming the built and artificial environment. We can see that energy is imbedded in lines/human streams of traffic and, this condition offers the lines another aspect of everlasting resourcefulness, which extends to any scale, from macro-scale (city and its districts) to micro-scale (plans of a single building of any size). Cities are made of infinite vertical and horizontal lines ; lines form its edges and boundaries.

Most of the times, lines explode from a nodal point towards a variety of unpredictable directions. If we follow the lines with our bodies, we become part of that play, too. We are actors and doers at the same time ; we are willing to participate into an everlasting and fascinating urban drama at any time; our bodies twist and bend and start moving. Hence, our bodies need to start their ritual routes everyday by considering plainly that *telic* act of performing lines ; our bodies duly perform along lines of eternal movement. Although some lines may have been already performing for many hundreds of years in human history and maybe ceased to exist, we are still able to re-discover them in places, such as ancient temples and, once in ancient times, as thriving

¹ G. Apollinaire, *The Cubist Painters*, New York, G. Wittenburn publishers, 1970, p. 13.

agora (market) places as we saw above. Lines penetrating inside built and open spaces generate pathways of everlasting rituals. Once we discover them and get involved with their energy, we become part of them unconsciously. Our bodies may describe often tortuous extensions of them at all directions in an effort of our body language to describe personal space. This action expresses all kinds of emotions which are prompted by extremely profound interactions of all parts of our body acting and interacting during kinaesthetic movements and processes.

HIGHLY ENERGETIC ANCIENT AND OLD ENVIRONMENTS STIMULATING BODY RITUALS

During the last decades, several authors affirm that contemporary urban sprawl should follow eternal hidden agendas of people's ritual paths in time². These powerful elements are preserved in both natural and manmade environments and become detectable when people start moving along them to reach habitually personal destination points. Paths become instinctive attraction mostly in unconscious ways ; they become part of human bios by revealing people's life and performances at all times. The human body becomes a form amongst

² C. Alexander, S. Ishikawa, M. Silverstein, M. Jacobson, I. Fiksdahl-King, S. Angel, *A Pattern Language*, New York, Oxford University Press, 1977 ; N. A. Salingaros, *A Theory of Architecture*, Solingen, Umbau-Verlag, 2006, 2008.

other forms and as Merleau-Ponty says a "body sees and is seen (...) visible and mobile, my body is thing among things (...) because it moves itself and sees, it holds things in a circle around itself"³. This assertion became very obvious to the author of this paper, once she had the opportunity to take part with two selected students (who attended her theoretical modules in 2011-2012 in the University of Derby) in the latest Erasmus project Dance Architecture Spatiality (DAS) in Athens in July 2012. Human bodies of students had explored spaces through their own spirituality and with their bodies moving harmoniously in them. They had the opportunity to see and feel space so that their bodies freely could describe unusual personal volumes of temporary habitation by ancient temples, by having ancient landscapes as background, by moving along eternal powerful paths (which had appeared in the remote historical past of the ancient city of Athens). During this experience, the author observed student training and performance ; she had then noticed how human bodies stimulated by their surrounding environment could manage to describe extraordinary personal spaces, whilst moving inside a cluster of more bodies on the move and along paths, in such closeness that only body heat was to guide bodies at times. During the activities of DAS in Athens,

³ M. Merleau-Ponty, "Eye and Mind" in H. Osborne, (ed.) *Aesthetics*, Oxford, Oxford University Press, 1978, p. 59.

students worked a lot in the open space and challenged their bodies by being close to natural elements (rocks, trees, top soil of paths, fields and artefacts made of raw materials, such as marble, clay, etc.) to move in a personal and unique ritual way. The author saw them forming harmonious spaces around their individual bodies or in combination with others by following own mental paths. Old paths surrounding temples or climbing hills opposite to ancient important monuments inspired these special rituals in such a way that often geometries of human movement were clearly visible in a multiplicity of three-dimensional forms imitating often combinations of surrounding shapes and forms. Every single human body of each student was reduced to a cosmic moving point to describe *chòros* (space in Old Greek) and, as a matter of fact, because *òros* means also "boundary and edge following certain spatial rules", human bodies were visibly selecting continuously specific and personalised regulating geometries to include their actions on the move and along pre-existing and highly energetic historical pathlines. As Kemp and Walker put it in their *Leonardo on painting*, "in the eye the shapes, the colours, all the images of the parts of the universe are reduced to a point and this point is a marvellous thing"⁴. According to Leonardo, as the authors above affirm "the boundary

⁴ M. Kemp, M. Walker, *Leonardo on Painting*, New Haven and London, Yale University Press, 1989, p. 50.

of a body is not part of that body, but the boundary of a body is the start of another. The boundaries of bodies are the least of all things"⁵. It is clear that what happens with Leonardo's pictorial boundaries of bodies can be revealed and expanded to three-dimensional spatial metaphors as well.

Several authors, like Krome Barratt, mathematician, affirm that people's emotions are stimulated by signs seen by the eye and by associated schemes and ideas ; the author believes that surroundings made by "ever changing" and "never changing"⁶, lines are capable to generate emotions ; lines are so powerful that can be transferred from *bios* codes (as described in Biourbanism) to everlasting virtual reality spatial agendas in order to inform and regulate architectural and urban design creativity and scales, from macro to micro scale. According to the same author, forms and boundary surfaces can offer emotional stimulation ; multiplicity of dramatisation of signs perceived as ideas at the end can stimulate the intellect. Forms and surfaces in the surrounding environment act as a catalyst so that a pathline, which offers highly enriched signs and stimulation, could become a preferential route of everyday life rituals and pleasant journeys which are repeated again and again and as far as it could go with

⁵ *Idem*, p. 53.

⁶ K. Barratt, *op. cit.*, p. 186.

history and evolution of landscapes and cityscapes, too. In this case, harmony is always dictated by universal natural laws, because architecture and spatiality can manifest equilibrium through harmonious performances of human bodies interacting often closely between them to create everlasting physical and spiritual equilibrium together. Human mind works through the eye, which observes and selects symbols and suggestions. According to Walter Crane, historian, “where there is life, movement, humanity, there is sure to be character and interest [rituals inspired by personal choices]”⁷. According to the same author ‘interweaving’ lines reveal movement and describe directed energy; this kind of lines represents human flows of movement into space. Thus, line is highly performing when in contrast with another line or a group of lines; this was clearly evident when students performing in DAS were asked to make their harmonious move along lines along which they were not obliged to follow a straight pathline strictly. They were able to create their personal convoluted movement around other bodies following the same mental pathline. In this case, the author managed to see and capture multiple interweaving spatialities in synchrony to form an entire moving space and slowly changing form and balance with extreme and aesthetically pleasing plasticity.

⁷ W. Crane, *Line and Form*, Manchester, George Bell and Sons publishers, 1904, p. 151.

Ancient background information of powerful monuments was also acting as juxtaposing layer of historical influence to the entire performance and added depth to the spatial views and environmental sightings. According to Barratt again, ‘drama can be enriched beyond competition between two themes by the use of transitions and interweaving plots’⁸.

NEW CHALLENGING OPPORTUNITIES OF BIOURBANISM : THERMODYNAMIC CONDITIONS OF THE BUILT ENVIRONMENT WITHIN HISTORICAL CONTEXT.

As we saw above drama made of human actions can reveal quality of life and bios at the same time. Drama communicates contrast and thus, it does not lead to apathy, as mechanical repetition does. Rich or gradually enriched dramas in historical spaces can make us think that also urban modern interventions should be expanded. Thus, newly enriched scenarios of the past are in ongoing natural evolution, which is fully regulated by laws of nature and physics most of the times. The author of this paper had previously stated that “the same kind of pathlines found in pictorial images can be also encountered in three-dimensional urban structures ; urban genesis is a natural event which depends upon dynamic routes created

⁸ K. Barratt, *Logic and design: Art, Science and Mathematics*, London, The Herbert Press, 1980, p. 301.

by movement of highly active points-units”⁹.

The author has been involved in Biourbanism since 2010 and had often the opportunity to discuss her ideas with other colleagues through Peer-to-Peer (P2P) processes ; these new discussions reinforced more what she had been observing and teaching also for several years now. She has now consolidated long years of research and teaching into cherishing of a newly evolved form of urbanism : Biourbanism, which is strictly related and interested in human ‘bios’ (not only revelation of being alive and thus of life) regulatory frameworks for modern landscapes and cityscapes. Amongst other findings confirmed by Biourbanism principles, the author saw that, important historical events can act as dynamic tensions or contrasts at all times; these contrasting scenarios are capable to set in movement cell-points/people inside a cosmic ordered environment. Cities are cosmic ordered pluralities of spatial interactions of human beings and thus, they should be treated, regulated and designed as such. On the top of classical geometries we are now able to see newly discovered geometries evolving together ; people’s movements in interweaving fractal geometries have now made us introduce

⁹ E. Tracada, “Design Codes and Design Language”, in K. Hatton, (ed.) *Design – Pedagogy – Research : Leeds 2007*, Huddersfield, Jeremy Mills Publishing Ltd & Leeds College of Art and Design, 2008, p. 47.

richness to our urban scenarios. This existence of rich fractal scenarios and pathlines was clearly evident during DAS training, workshops and performances, too. Therefore, as the author discusses in this paper and, as Prof. Nikos Salingaros has affirmed repeatedly in his work, laws of thermodynamics have always regulated and will continue to regulate our drama of actions and interactions with our surrounding environments, as explained further in this paper. Drama and interactions create spaces and architecture according to laws of nature.

Nature follows fractal geometrical patterns, often attracting the attention of artists and photographers¹⁰. Nature prefers ordered complexity to guarantee its biological life, as in the case of the Iberian Peninsula wetlands above. Many authors, like Christopher Alexander believe that, “the texture of space is governed by the same rules at all scales; from the scale of the planet, down to the scale of a pebble”¹¹ ; that means as a projection of what nature offers us and by fractal qualities, found in historical urban fabric. Although urban space and architecture could be complex and fractal, the processes which generate successful spaces should be summarized

¹⁰ For example see : Sancti Petri-La Barrosa, Chiclana, Cádiz : “Deposits of fluvial-marine sediments crossed by a complex network of secondary channels subjected to a process of fluctuating tidal flooding” in source <http://fractaltonana.blogspot.com/>.

¹¹ N. A. Salingaros, “Urban space and its information field”, *Journal of Urban Design*, 1999, volume 4:1, p. 30.

in only three axioms dealing with urban space.

According to Salingaros, “urban space is bounded by surfaces that present unambiguous information”¹² - axiom 1 ; its spatial information field defines “the connective web of paths and nodes”¹³ - axiom 2 and the “core of the urban space is pedestrian”¹⁴ - axiom 3. The axioms provide the basics for urban planning by referring to more basic level rather than large scale decisions often revealed by complex network grids. Thermodynamics in architecture are related mainly to bounding surfaces or better, to “structural pieces surrounding an open space”¹⁵ ; they should show the maximum information to the people who use that geometrical urban space. Thus, the urban spatial boundaries act as generators of positive space stimulating the human senses. Therefore, the geometry of these boundaries should guarantee coherence in positive urban space.

Towards the end of the 20th century, fractal theory has become popular in urbanism and planning. Many authors insist that, successful urban forms should be fractal, although mainly they refer to large-scale urban design

based upon pathlines’connectivity. Nevertheless, by considering urban space as defined by special boundaries, which transmit specific information (exterior fractal architectural elements) and by developing the “information field through geometric subdivisions”¹⁶ we are able to provide building surfaces “with fractal scaling, from the size of the buildings”¹⁷ down to the materials, hence, being in plain control of fractality in peripheries. A “typical town is not a pattern of streets, but a sequence of spaces created by buildings”¹⁸.

A design based upon fractality deals with natural scaling hierarchy and it is capable to influence the viewer, because it helps with the process of human perception. Human beings can “perceive a complex structure by reducing it to a number of distinct levels of scale”¹⁹ and, in this way, excess of information can be easily avoided. In the 1990s, the effects of computation to the human eye and brain started being studied and research proved that, at first, the human brain forms clusters of “similar units of the same size into one scale”²⁰ and then, it starts comparing sizes and scales between them. The human brain can easily perceive fractal self-similar shapes, forms and structures by clustering them

at different sizes and scales ; the human brain has been trained to distinguish patterns found in nature and also perceives accurately the natural scaling hierarchy of fractality. The eye gets signals and the brain analyses them according to a certain set of rules for recognising hierarchical cooperation of self similar patterns; the latter can be easily mapped and visually identified as such.

By considering architectural comfort some authors, like Salingaros, have tried to examine how the small and large scales contribute to the accomplishment of architecture whatever its coherence could be. Salingaros uses methods of quantifying architecture according to geometrical and visual content and also claims that, it is possible to compare two buildings based on intrinsic, computable values of their design. The same author also insists that, these scientific values can influence the importance and feeling of a building (how residents and/or users feel about it); he also identifies some architectural tools for dealing with and understanding the organisational component of design. This latter point of his has reinforced the belief of the author of this paper, on every occasion she teaches studio design practices to students in Higher Education at all levels, from Level 4 to Level 8. Theories and histories of design and architecture can provide some important experiential tools to

both architectural and urban design solutions. Nevertheless, these tools should be reinforced further by vigorous quantifying tools also linked to relevant sciences, such as mathematics, physics and biology on the top of observations made on human behaviours and rituals.

Nikos A. Salingaros has set a simple mathematical model, which draws on analogies of thermodynamics and can be considered as an innovative approach to design ; he has identified two distinct qualities and has provided some basic information how to measure them. He describes small-scale structure as the architectural temperature T . The higher the architectural temperature T is, the higher the intensity of the design and the degree of visual stimulation is also revealed, as it happens to be seen clearly in ancient buildings, such as temples and agora places. He identifies the architectural harmony H , another measure, as the degree of symmetry and visual coherence of forms, capable to measure visual organization. Salingaros has related the hypothetical architectural life L and architectural complexity C to a variety of combinations of T (Temperature) and H (Harmony). His architectural life L is defined by the formula $L=T \times H$ and his architectural complexity C by the formula $C=T \times (10- H)$.

The architectural life L refers to the quantity that, a user can recognise critical qualities in a building or artefact

¹² N. A. Salingaros, *Principles of Urban Structure*, Amsterdam, Techne Press, 2005, p. 42.

¹³ *Idem*.

¹⁴ *Ibidem*.

¹⁵ N.A. Salingaros, “Complexity and Urban Coherence”, *Journal of Urban Design*, 2000, Vol. 5, p. 291-316, <http://zeta.math.utsa.edu/~yxk833/UrbanCoherence.html>.

¹⁶ *Idem*.

¹⁷ *Ibidem*.

¹⁸ N. A. Salingaros, *Principles...*, *op. cit.*, p. 53.

¹⁹ N. A. Salingaros, “Complexity and Urban Coherence”, *art.cit.*

²⁰ *Idem*.

that make it seem alive. He refers to Christopher Alexander's ideas about critical qualities that connect us "with a building in the same way that [we connect] emotionally to trees, animals and people"²¹. Complexity C can be a positive or negative value ; it depends on the fact that, it can trigger interest and excitement, which may reach the highest degree of anxiety. The final part of Salingaros model demonstrates how to fill a building with life/bios by adjusting individual elements of forms. He affirms that "the architectural temperature is determined by several significant factors, such as the sharpness and density of individual design differentiations, the curvature of lines and edges and colour hue"²².

Salingaros distinguishes five elements/ components, T1 to T5 that contribute to Temperature T. Each quality is measured on a scale by assigning a value of 0 to 2 according to a rough judgement, as follows : very little or none=0, some=1, considerable=2. The quantity T would range from 0 to 10. He proposes :

- T1= intensity of perceivable detail
- T2= density of differentiations
- T3= curvature of lines and forms
- T4= intensity of color hue
- T5= contrast among color hues²³.

²¹ *Idem*.

²² N. A. Salingaros, *A Theory of Architecture*, Solingen, Umbau-Verlag, 2006, 2008, p. 107.

²³ *Idem*.

In a similar way, architectural harmony H is associated with visual organisation and measured as the sum of five components, too :

- H1= reflectional symmetries on all scales
- H2= translational and rotational symmetries on all scales
- H3= degree to which distinct forms have similar shapes
- H4= degree to which forms are connected geometrically one to another
- H5= degree to which colors harmonize²⁴.

It is explained that, there is a deep connection between architectural harmony and information in thermodynamics, which is carried over to architecture and also urbanism. Usually brain recognition is frustrated whenever architectural structural information is mainly missing. Conjecture on perception ; the brain works combinatorially ; tries out all possible geometric combinations, deciding which is more effective of understanding ; in the absence of explicit groupings, this process leads to stress and fatigue²⁵.

Hence, we strive for raising architectural harmony of a variety of structures, which are unrelated, for example, by scaling through transitional regions of links. A geometrical link connects two

²⁴ *Idem*, p. 110.

²⁵ N. A. Salingaros, *Twelve Lectures on Architecture – Algorithmic Sustainable Design*, Solingen, Umbau-Verlag, 2010, p. 31.

separate structures and will become a boundary for both of them, sometimes a path. At this point, we can understand how fractality of urban space manages to maintain continuity and healthy, uninterrupted human activities to reinforce boundary expansions around preferential human activity nodes. Salingaros says that "Scaling symmetry creates coherence; similar shape when a fractal's particular details are magnified ; the brain handles information encoded in a fractal than if random"²⁶.

CONCLUSIONS

The students in DAS produced either theoretical schemes or proposals of design and wrote critical essays/papers on a topic related to the materials in which they were taught and trained during our fortnight workshops. Not only architectural complexity was investigated, but also harmony and viability of urban space was measured by spatial exploration of body movement in connection with topographical randomness.

Harmony and temperature can guarantee intensification will be interrelated strictly to current and future intensive models of fractal and healthy urban sprawl. The word life is going to encompass architectural life of a building and urban space via coherent fractal intermediate regions.

²⁶ *Idem*, p. 39.

As a matter of fact, urban space and architecture should be closely following laws of biological complexity in order to be able to guarantee an ongoing evolution of more inclusive cities through human-oriented spatial and urban designs. We also saw that human bodies unconsciously follow the same principles when they try to connect with natural and artificial environments. In order to tie sciences and human-oriented spatiality of bodies which move within Euclidian and fractal patterns of lines, the author should like to conclude by referring to the milestone theories of fractals in the 1990s, as follows :

The notion that cities are self-similar in their functions has been writ large in urban theory for over a century, and is manifest in terms of [measurable] relations... What this new geometry is beginning to do is to tie all these notions explicitly together in a geometry of the irregular, a geometry of the real world²⁷.

²⁷ T. V. Mesev, P. A. Longley, Y. Batty, M. & Xie, "Morphology from imagery : detecting and measuring the density of urban land use" in *Environment and Planning A*, 1995, vol. 27, p. 760-761 (<http://www.paul-longley.com/files/2009/04/morphology-from-imagery-envir-plan-a-1995.pdf>, last accessed on 10/02/2013).