THE PATTERNS OF ARCHITECTURE

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EDITORS' INTRODUCTION

Pattern theory has not as yet transformed architectural practice—despite the acclaim for A Pattern Language, [1] *Christopher Alexander's book, which introduced and substantiated the theory. However, it has generated a great amount of far-ranging, supportive scholarship. In this essay Nikos Salingaros expands the scope of the pattern types under consideration, and explicates some of the mathematical, scientific and humanistic justification for the pattern approach.*

The author also argues for the manifest superiority of the pattern approach to design over Modernist and contemporary theories of the last one hundred years.

To a great extent Dr. Salingaros's conviction rests on the process and goals of the pattern language method which have as their basis the fundamental realities of the natural world: the mathematics of nature (many that have been studied since the beginning of human history); the process of organic development; and the ideal structural environment for human activity. For Salingaros, Alexander, et al. aesthetics in Architecture derive from these principles rather than from notions of style or artistic inspiration.

AUTHOR'S INTRODUCTION — KEY PATTERN CONCEPTS

Pattern. A *pattern* is a discovered organization of space, and also a coherent merging of geometry with human actions. In common usage "pattern" has an expansive definition. In Architecture "pattern" often equates with "solution". In any discussion of architectural pattern theory the word "pattern" itself is used repeatedly, often with reference to somewhat different concepts. This can be confounding.

As a rule the patterns catalogued in *A Pattern Language:*

- represent the successful designs that Alexander and his team found recurrent in their extensive architectural research across time, cultures, and climates (as a historian might find, say, a *pattern* of population density near bodies of water);
- as such these designs are also patterns in the sense of prototypes, or templates, freely available to be emulated, and modified (much as a dressmaker's pattern);

[1] Christopher Alexander, S. Ishikawa, M. Silverstein, M. Jacobson, I. Fiksdahl-King & S. Angel, *A Pattern Language* (New York: Oxford University Press, 1977).

• With reference to Spatial Patterns: "pattern" often refers to designs or arrangements of figures (for example "the geometrical *pattern* of a rug").

This essay primarily concerns the two principal pattern categories: "Spatial Patterns" and "Living Patterns" defined below.

Living Patterns. The term *Living Patterns* refers to the socio-geometric patterns in *A Pattern Language*. These are detailed, contextualized presentations of: the component parts of a structure, its immediate environment—a town or select region, *et cetera*—and their integration into the larger project. An architect can consult the book for solutions to a full range of design dilemmas.

In this essay the term more often refers to the Living Pattern concept—its requirements, the design techniques for its realization, and other tools for Architects to use to begin compiling their own *pattern language*.

Both *A Pattern Language* and this paper are grounded in the sequential, combinatoric nature of the pattern method in which each step evolves from the step before, creating a harmonious whole.

Spatial Patterns are outside the scope of *A Pattern Language* but are necessary unifiers of the different elements of any Living Pattern. Spatial Patterns combine structural and visual elements coherently. Generally a Spatial Pattern is a two-dimensional design perceived at the level of human sight, whose smaller scale supports and unifies—cognitively or visually—the larger structure. Examples are the Spatial Patterns of ornament or decoration. Spatial Patterns on a building's interior surface help orient the user to the scale and navigation of the whole. On a building's exterior surface Spatial Patterns provide necessary coherence and appeal.

Complexity. This word—and versions of it—is among the most frequently occurring in this essay. Architectural design is a highly complex undertaking, combining many components that may also each be complex. Heretofore, the basic creative processes that generate complexity have not been made clear despite many attempts to do so. Comprehensive and humanistic, pattern theory is a major contribution to the field of managing complex systems. Decomposing a living city into simplistic Spatial Patterns destroys its essential complexity; the correct decomposition is into its component Living Patterns.

There are many examples of non-evolved (that is, non-sequential, non-combinatoric) patterns from the twentieth century that fall below the complexity threshold found in all evolved complex forms. The most suitable, harmonious designs are inherently complex.

Process. The reader will note throughout this paper that intrinsic to the pattern approach to Architecture is the step-wise, adaptive process for designing each element of a structure. This process results in structures and environments that are adaptive both to initial conditions and human physical use and sensibilities A close analogue to this process is the

development of biological organisms. This is the opposite of the commonly used "all-at-once" design method. Regardless of a building's size it is impossible at the beginning of the process for an Architect to envision let alone resolve all of the critical decisions that emerge only as the design develops. Designing without an adaptive process defaults to forcing the result to conform to formalism.

Christopher Alexander specifies an *algorithmic* method (that is, a set of instructions for step-wise design development) to achieve integrality. Following this iterative system a determination is made at each juncture as to, for example:

• the scale of the just drafted component;

• the degree to which it reinforces the designs of same-scale elements; its geometrical congruence with the higher and lower scales of the scaling hierarchy;

• its contribution to wholeness (overall coherence and connectivity); its fulfillment of human-adaptive goals; and the need to modify any weakness so identified in the component (that may lead to adjustment elsewhere).

Coherence of the entirety depends on the feedback from these systematic computations. [2] The step-wise, algorithmic method ensures both the integration of each discrete part into the whole (and vice versa), and a whole that is more than the sum of these parts. In time, Artificial Intelligence may be available to perform some of these functions with the designing Architects integrating nuance and judgment from their experience.

Another indication of the immanence of this pattern process is its expansion into fields beyond Architecture, most notably software engineering. For example, Alexander's process is the basis for the development of Wikipedia. [3]

SYMMETRIES CREATE SPATIAL PATTERNS

Our bodies and brains have evolved to deal with an enormous amount of environmental information, if that information is ordered properly. People are overwhelmed by the disordered information such as is represented in deconstructivist buildings. The opposite case is visually empty environments: the sheer, flat surfaces common in minimalist structures lack the information a person needs to connect to the world. Both extremes cause psychological, often physiological discomfort.

Architecture, as indeed all of life, is the result of complex computational processes and, just as with organismic development in nature, each step supports—and is informed by—the step before. Thus an ordered structure evolves that efficiently channels the energy that drives the life process. The simplest Spatial Patterns are visual representations of

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[2] For more information on this process see Michael Mehaffy and Nikos Salingaros "The Wholeness Generating Technology of Christopher Alexander", *Metropolis,* October 2011, http://www.metropolismag.com/Point-of-View/October-2011/The-Wholeness-Generating-Technology-of-Christopher-Alexander/
This is Chapter 20 of Michael W. Mehaffy & N. A. Salingaros, *Design for a Living Planet: Settlement, Science, and the Human Future* (Portland, Oregon: Sustasis Press, 2015).

[3] https://en.wikipedia.org/wiki/Ward_Cunningham last consulted November 12, 2016

relations, where units with some form of symmetry generate a larger whole that is rich with information easily assimilable by the human brain.

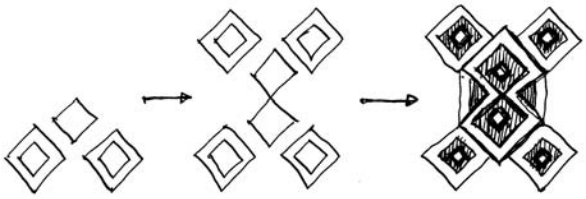

Figure 1. Components generate a larger-scale Spatial Pattern via symmetries. The larger-scale pattern has emergent properties not expected from the basic components.

TABLE 1. THE THREE PRINCIPAL SYMMETRIES AND THEIR SIMPLEST COMBINATION:

1. *Reflectional* symmetry about an axis joins a pattern's mirror image to the original pattern to create a bilaterally symmetric object.

2. *Translational* symmetry shows invariance after displacing a pattern in one direction by a specified length.

3. *Rotational* symmetry shows invariance after rotating the pattern by a specified angle around a central point.

4. A *glide-reflection* is the simplest way to combine translations with reflections: move a unit, and then reflect it across the glide axis.

Altogether, there exist 17 symmetry groups (called "wallpaper groups") that include the three basic plane symmetries and their 14 possible combinations in two dimensions. Most of the classic two-dimensional tiling patterns can be found throughout human history in both Art and Architecture until the early twentieth century.

Symmetries generate even more complex patterns in three dimensions. The key again is to repeat non-empty units on the smaller scales to generate coherent structures on a larger scale.

There are biological reasons for using symmetries in what we make, as witnessed over our entire cultural evolution. Symmetries significantly reduce the amount of information that needs to be processed by the brain. [4] In a random design, by contrast, every single point has to be coded for representation, which is too much information for the human cognitive system to handle simultaneously.

The rules of symmetry regulate the creation and scaling of Spatial Patterns. Components on the same scale are related using various common forms of symmetry. Spatial Patterns on different scales relate though scaling symmetries creating logical, predictable changes along the hierarchy.

[4] Nikos A. Salingaros, *A Theory of Architecture* (Portland, Oregon: Sustasis Press, 2014).

The evolved Spatial Patterns of Architecture function as connectors of the different levels (scales) of the whole. Crucially they also provide focal points to orient the user. Our eyes connect to surfaces by focusing upon specific points. We thus rely upon details (among other factors) to experience an architectural space.

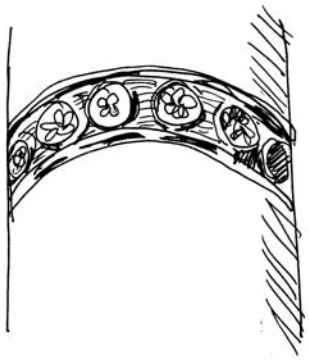

Figure 2. Ornament, which is coherent, ordered structure on the smallest scales, connects us to the larger-scale structure.

Because each scale of a structure needs to be well defined, Spatial Patterns cannot just repeat indefinitely but, following the designer's mathematical model, become incorporated into patterns on a higher scale. This leads to system coherence. As the scale increases new patterns should emerge. This "emergence" is exhibited in both living systems and artificial complex systems, where increasing complexity gives rise to new structures on higher levels of scale. As wonderful as mathematical fractals are, they do not provide a good model for adaptive design because the same rule generates every scale.

Our objective should be to enable a positive visceral connection between the user and the built environment. That cannot be achieved through the studied disconnection of minimalist spaces and surfaces, on the one hand, or through shattered forms and twisted geometries, on the other. As Mark Anthony Signorelli states in his critique of Modernism, and endorsement of evolved traditions:

> [W]e may correctly distinguish between pre-modern traditions and the modernist tradition. Whereas earlier traditions of artistic creation embraced symmetry within complexity, Modernism has embraced extreme simplicity, dislocation, and imbalance… Whereas pre-modern Architecture employed scale and ornament, modern Architecture aggressively promotes gigantisms and barrenness. [5]

The key to a positive emotional response is the coherent cooperation of Spatial and Living Patterns from many different scales. Ornament can be essential in articulating this cooperation. It is never something that's merely "stuck on".

[5] Mark A. Signorelli and Nikos A. Salingaros, "The Tyranny of Artistic Modernism", *New English Review,* August 2012.

LIVING PATTERNS AND BIOPHILIA

Going beyond the purely visual realm, Living Patterns are found on both the architectural and urban scales. Because meeting human needs is the *sine qua non* of Living Patterns, by definition they contain a core, or invariant, element—one historically proven to enhance people's interaction with the built environment. (See paragraph below, and "PATTERN 106: POSITIVE OUTDOOR SPACE")

In one striking example, *A Pattern Language* researchers tested—and identified as fundamental—people's invariable preference (tantamount to a need) for a room with natural light from at least two sides, over a room with light from one side only (a bad example being the notoriously dreary apartments in Le Corbusier's *Unité d'Habitation*), or no natural light at all. [6] It's hard to overstate the importance of meeting this need when making a healthy environment. Many Living Patterns have a solid biological basis, which is now being discovered through the new discipline of Biophilia. [7]

Once discovered, this valuable information should be documented as a "Pattern", otherwise the successful combination will be forgotten. This is how life works: when a life form or metabolic mechanism is discovered, they are encoded in DNA so that the solution will not be lost.

TABLE 2. PRINCIPAL FEATURES OF BIOPHILIC PATTERNS:

1. A complex ordered structure of decreasing scales.

2. Self-similarity/scaling symmetry.

3. Spatial Patterns following the symmetry principles described above.

4. Sophisticated fractal and cellular automaton patterns (See Figure 5).

5. Ordered complexity embodied in Spatial Patterns on a small scale that coordinate through symmetries to produce a coherent whole.

Adaptive design is highly dependent upon initial conditions: existing structures, surroundings, different human needs, *et cetera*. The same adaptive design process will result in drastically distinct end products. Thus Living Patterns are never imitative. Designing according to pattern theory leads to original, adaptive results because the design develops organically: each step accepts feedback from the existing structure, mimicking the biological development of the embryo. [8] This is the opposite approach from generic, industrial design, which relies on a self-contained, strictly structural computation that cannot accommodate any human needs beyond the bare minimum. Adaptivity is the fundamental reason it is imperative that Living Patterns become part of any formal design method.

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[6] Christopher Alexander *et al.*, *A Pattern Language*, Pattern No. 159.

[7] Stephen R. Kellert, J. H. Heerwagen & M. Mador, Editors, *Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life* (New York: John Wiley, 2008).

[8] Christopher Alexander, *The Nature of Order*. Book 1: *The Phenomenon of Life*, 2001; Book 2: *The Process of Creating Life*, 2002; Book 3: *A Vision of a Living World*, 2005; Book 4: *The Luminous Ground*, 2004 (Berkeley, California: Center for Environmental Structure, 2001-2005).

Living Patterns satisfy all the requirements of Spatial Patterns: a set of relationships; the ability to combine patterns on the same scale; and the emergence of new patterns on a larger scale.

Biophilic principles make explicit the intuitively understood human need to connect to other living organisms and the firmament for essential nourishment.[9] Numerous experiments privilege an environment rich in biophilic patterns over plain industrial surfaces that might be preferred by Architects on the basis of style.

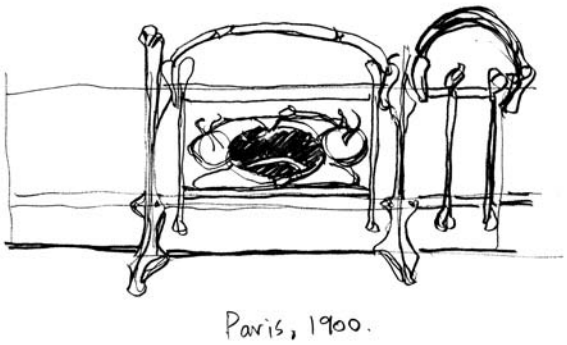

Figure 3. The curves and colors of Art Nouveau architecture make it intrinsically biophilic.

These general attributes are also observed in geometries that encompass the entire spectrum of biological structures.

In his later work, Alexander joined Spatial with Living Patterns into a universal geometric framework codified as Christopher Alexander's "fifteen fundamental properties".[10] Having grasped the separate meanings of Spatial and Living Patterns, the interested reader is then in a very good position to appreciate these newer results, which reveal the reasons why patterns work.[11]

Minimalism and deconstruction used for shock effect eschew biophilia and Living Patterns.[12] They obviously violate all of Alexander's fifteen fundamental properties as well. We would like to believe that, with a more educated public, those are no longer serious options in design: they were fads that flopped. The richer and more ordered the environment, the more human beings feel alive and enjoy being there. This assessment is backed by scientific knowledge, not architectural or aesthetic opinion.

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[9] Nikos A. Salingaros, *Biophilia and Healing Environments* (Portland, Oregon: Sustasis Press, 2015), available online from Terrapin Bright Green LLC, New York.

[10] Christopher Alexander, *The Nature of Order*.

[11] Nikos A. Salingaros, *Unified Architectural Theory: Form, Language, Complexity* (Portland, Oregon: Sustasis Press, 2013), Chapter 19: "Alexander's 15 Fundamental Properties".

[12] Pattern thinking was co-opted recently in an attempt to boost the work of currently popular star-architects. But their buildings have absolutely no relationship to either Spatial or Living Patterns. Coming from contemporary art, writers who evidently misunderstood what an architectural pattern is participate in public relations stunts masquerading as scholarship. This leaves any reader wishing to learn about patterns totally confused.

Reversal of Spatial and Living Patterns. Ever since Modernism abandoned Architecture's evolved foundations, Spatial versus Living Patterns have become confused and may trip up even the best intentioned Architects and Urbanists. In pursuit of the eternal "new" at all costs, modernists reversed the scales on which patterns are applied leading to disastrous results. For example, an attractive repeating visual pattern might be appropriate for ornamenting the frame of a door; but such a Spatial Pattern taken out of context, magnified, and applied to the ground plan of groups of buildings may well cut across Living Patterns that those buildings must satisfy to be useful living environments.

Miniature models used ubiquitously in architecture school studio and to win competitions are judged predominantly by their visual (or Spatial) patterns; by how aesthetically interesting the shape is on the actual miniature scale. No thought is given to how Living Patterns may or may not be satisfied when such a structure is built on the real scale. Today an Architect who wishes to build for human sensibilities, would refer to the Living Pattern techniques that evolved over generations of adapting to human use.[13] Whereas these methods are freely available as shared patterns, their implementation is discouraged or even illegal. Architectural culture, working strictly within a formalist industrial design paradigm, has embedded its rituals into law.

Mainstream practice erects structures that are poorly adapted to life. Yet today's Architects are easily able to convince their clients to fund monstrous abstract sculpture, in what has become the reigning architectural paradigm. Without instruments such as Living Patterns very few of these buildings provide good, or even adequate human environments. This startling conclusion can be proven by reference to architectural patterns in *A Pattern Language* and abundant related literature.

THE NATURAL HIERARCHY OF SCALES

In physics, positive nuclei couple with negative electrons to create atoms. The process continues when atoms couple into molecules, molecules couple into crystals, and so on to generate all the elements. Elements form minerals, which combine into planets and stars, and stars collect into galaxies. Galaxies themselves coalesce into galactic clusters. At every scale, there is a mechanism for organizing otherwise scattered matter into coherent wholes.

Drawing an analogy with Architecture, design that appears coherent is neither minimalist nor simple, but reveals a much richer substructure and scaling information upon close examination. Employing symmetries and symmetry-breaking mechanisms (See Figure 4) along with scaling strategies generates the requisite variety on smaller scales.

[13] Nikos A. Salingaros, *Living Structure Should Come From Living Patterns* (New York: Metropolis, 2016), a series of online essays.

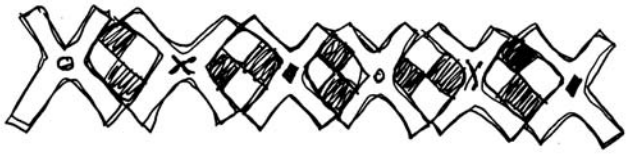

Figure 4. Alternating repetition with symmetry-breaking creates an irreducible hierarchy in which the individual units are approximately yet not exactly the same.

Natural materials usually show fine-grained structure around ¼ mm to 1 cm. Next, traditional ornament serves an essential mathematical function, defining the scales from 4 mm to 20 cm between the microstructure in the materials and the tectonic components, thus completing the spectrum of smaller sizes. From 20 cm on up, tectonics usually generate their own hierarchical system of scales. Minimalist design does away with all of this, even going to great lengths to remove natural detail and to hide tectonic subdivisions. This is the reason for an unreasonable insistence on industrial materials: they are manufactured without micro symmetries and so they lack identifiable structure even on the scales ¼ mm to 1 cm. This aesthetic preference has unfortunately become embedded in misguided ideological constructs that discourage pattern implementation.

Fractals, also cellular automata (See Figure 5), make possible a new generation of innovative ornamentation to define a building's hitherto neglected scales from 1 mm to 20 cm. A renaissance in craftsmanship, as advocated by Léon Krier [14] and others, would also contribute important design options. (Perhaps paradoxically education in hand-crafting is being introduced in a few rust-belt school systems in the US to teach skills that may provide students with opportunities lost after the flight of industrial jobs to automation and lower wage countries.)

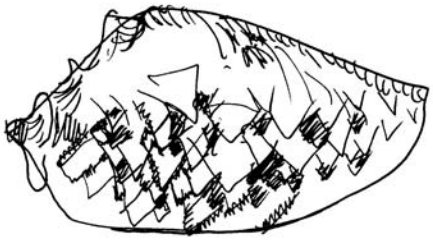

Figure 5. A pattern resembling "Rule 30" appears on the shell of the widespread Conus textile *species. Cellular Automaton Rule 30, introduced by Stephen Wolfram in 1983, is of particular interest because it produces complex, seemingly random patterns from a simple, well-defined rule. At a cellular level the* Conus textile *obeys Rule 30, developing this exquisite pattern. (Rule 30 is also used as a random number generator, with possible applications to cryptography.)*

[14] Léon Krier, originally published as *Architecture: Choice or Fate* (Windsor, England: Andreas Papadakis, 1998). New edition with 3 additional chapters, *The Architecture of Community* (Washington, DC: Island Press, 2009).

There is simply no way to create a coherent hierarchy of scales if the lower scales are suppressed or are otherwise missing. [15]

Moving beyond restrictive ideological limitations to design, contemporary Architects can begin to apply a vast new toolbox of symmetries, patterns, and a system of ornament based on mathematics to link the small scale to innovative forms on the larger scales of their buildings, thus creating a biophilic environment.

INFORMATIONAL DELIGHT VERSUS MONOTONOUS REPETITION

With the aid of Artificial Intelligence we might expect a hierarchy of scales in future buildings, in which an intense and well-defined small scale is repeated in new patterns to generate the larger scales. This generates emergent properties, that is, the larger scales invent new information not present in the smaller scales. A person should experience informational richness (but not overload) on every scale of structure. Different scales in the hierarchy, each one equally interesting, give a distinct but equally rich experience at every distance of approach.

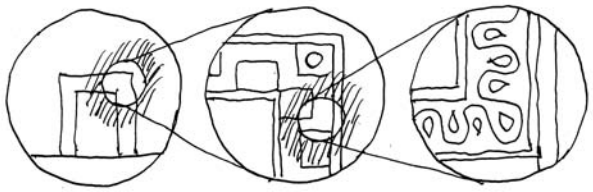

Figure 6. A more abstract explanation for one part of biophilia is that we connect informationally to every scale in a structure.

This process also avoids the mindless repetition to which people have a natural aversion. Consider prized traditional artifacts from all over the world—we rarely find a case of simplistic repetition: pottery, carvings, textiles, and carpets with repeating patterns reveal, upon closer inspection, that every unit has been made slightly different in order to prevent informational collapse. Failing to understand this principle, architects err by simply repeating units creating immensely boring façades and plans of buildings.

Since the 1920s design monotony has been pushed to the limit. The small scale is usually wiped out while, at the other extreme, large-scale symmetry is violated with disconcerting effects on the user. The worst results occur on the urban scale, where one urban unit is endlessly repeated, interspersed with parking decks, to create a city region of deadly monotony.

We see "fashionable" asymmetries in recent buildings everywhere. The futility of this visual game is intuitively obvious to users, who can instantly tell when a lack of symmetry is an irrational and wasteful artistic gesture that frustrates human movement. When asymmetry arises from adaptation, however, the configuration may be surprising but it is "comfortable" to our perceptual system.

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[15] Nikos A. Salingaros, *A Theory of Architecture.*

PATTERNS ON THE URBAN SCALE

Why are regions of historic urban fabric around the world, all very different from each other, perceived as more human than almost everything that has been built after the end of the Second World War? The usual stylistic criteria of evaluation used by Architecture professionals are useless as an answer. Only the emotional response identifying a positive state of wellbeing by ordinary residents and tourists has genuine value. The universal appeal of these regions—the basis for a major portion of the world's economy—is driven by unquestionably attractive, inviting qualities of the urban fabric. Yet this emotive evaluation most often runs counter to what we are supposed to like based on modernist architectural and urban theories.

For most of the twentieth century, cities have been planned following simplistic ordering, even though that approach can lead to an unlivable environment. It is not only monotonous to experience, but it can never define the multiple scales necessary for human life. Traditional urban fabric is, by contrast, endlessly complex and fascinating, with the result that it harbors and promotes a much livelier manner of life for its inhabitants.

Let us ask instead: "How can we reproduce today the human qualities of historic urban fabric?" A general computational method for doing so is based on previous work of Christopher Alexander's. [16] Living urban fabric possesses an extremely high degree of design complexity, whereas dead urban fabric (like Brasilia and Los Angeles) is the result of simplistic or random design operations. An urban region or entire city designed with negative geometrical qualities—either excessive simplicity or randomness—is instinctively perceived as dead. As a consequence its residents cannot lead fulfilling lives there. They may tolerate that environment, but will be forced to seek their environmental nourishment elsewhere.

Urban design that violates Living Patterns fails as a human environment. Countless examples of image-based design that looks "charming" on a plan or on a computer screen turn into dysfunctional urban insertions when implemented. That is painfully obvious to users. Yet this occurs repeatedly despite well-developed techniques of observing the human use of urban spaces applied over decades to distill practical design rules. Those empirical findings are totally ignored by an architectural culture that insists on imposing its aesthetic of mega structures and "junk-space" on the city.

It is necessary to explain why some urban regions criticized herein as being almost dysfunctional at first sight appear to function adequately. People are there, goods are exchanged, *et cetera*. The reason that they do work, at least superficially, is simply because of enormous energy expenditure. In those cases, connectivity and movement that are the essence of urban life are not facilitated by the geometry of the built environment, but are achieved by wasting human energy and fossil fuels. [17] As long as these are easily available, and inexpensive, then poorly planned cities that totally neglect Living Patterns can continue to work.

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[16] Nikos A. Salingaros, "Urbanism as Computation", Chapter in: Juval Portugali, H. Meyer, E. Stolk & E. Tan, Editors, *Complexity Theories of Cities Have Come of Age* (Berlin: Springer Verlag, 2012), pages 245-268.

[17] Michael W. Mehaffy & N. A. Salingaros, *Design for a Living Planet: Settlement, Science, and the Human Future* (Portland, Oregon: Sustasis Press, 2015)

Which brings us to a second important point with serious sociological ramifications. Wealthy residents are sufficiently mobile to be able to afford to reside in such a dead environment because they can easily get their environmental nourishment elsewhere. Poorer residents, however, are pretty much restricted in their movements, and their only environmental nourishment is from right where they live. Since Post-War environments tend to be dead, this essential source of emotional nourishment has been denied to several generations of people who are less well off.

How should we design living urban environments today? By following a sequence of interactive steps, each one of which is checked against adaptation to human needs and sensibilities. Living Patterns play a key role in this adaptive method. The design complexity should mirror the correct sort of adaptive complexity and avoid randomness.

Consider the main pattern for designing outdoor urban space—paraphrased from Pattern 106 in *A Pattern Language*. [18]

Pattern 106: Positive Outdoor Space. The built structures partially surrounding an outdoor space, be it rectangular or circular, must define, in its wall elements, a concave perimeter boundary, making the space itself convex overall.

As an example:

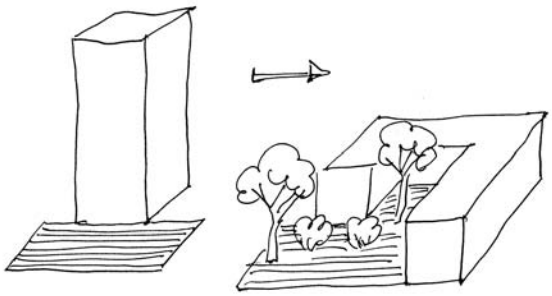

Figure 7. Morphing of a tall building's footprint and shape to create a semi-enclosed urban space saves what was psychologically unusable exterior space. The usable interior building volume nevertheless remains the same.

This typical Living Pattern establishes a very definite geometrical criterion for usable urban space. The open space has to be surrounded partially, but not totally, by attractive building façades. Urban space should feel like a giant open room to users, with attractive "walls". [19] Façades enclosing urban space, in order to be themselves coherent, cannot be minimalist glass or shiny undifferentiated metal. Furthermore, the surrounding perimeter of an urban space has to be semi-permeable, with doors, windows, and passages to enable pedestrian flow. Looking at successful urban spaces throughout history reveals precisely these qualities.

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[18] Christopher Alexander *et al.*, *A Pattern Language*.

[19] Nikos A. Salingaros & Pietro Pagliardini, "Geometry and Life of Urban Space", Chapter in: *Back to the Sense of the City, 11th Virtual City & Territory International Monograph Book* (Centre of Land Policy and Valuations/Centre de Política de Sòl i Valoracions, Barcelona, Spain, 2016), pages 13-31.

Nevertheless, Living Patterns such as this one are not taught in architecture school because they supposedly "restrict creativity"! As a consequence, designers don't know how to create a living urban space. Worse yet modernist Architects intentionally reverse the above Living Pattern because they wish their own buildings to stand out from the urban fabric—to draw attention to themselves. A building is surrounded by open space instead of the opposite and correct topology where urban space is enclosed partially by built fabric. No compromise is possible here.

The world has erected thousands of useless modernist open spaces ever since urban planners reversed the correct pattern. When a design rule damages the human use of the built environment, yet is repeated widely regardless, it is called an "anti-pattern". A careful investigation of urban planning codes reveals that anti-patterns such as the one where a building stands alone are set into the legislative basis for planning post-war cities. Consequently, it is often illegal to design and create cities with living qualities. There is no hope of improving our built environment without a massive change of legislation that dictates what one is, or is not allowed to build. Revising modernist urban and building codes to accommodate Living Patterns requires political action.

Evolved solutions based on Living Patterns were fruits of strong continuity in history. This practical creative tradition led up to supreme creations of buildings and adaptive urban components. But design in the twentieth century reversed the goal of adaptation, deliberately cutting itself off from its historical roots. In the last century many design and planning "innovations" have been introduced and, although much of the world accepts them as such, they are in reality anti-patterns. Applying them negates architectural and urban solutions that had evolved over millennia, reaching superbly adapted expressions. (Yet that negation was the very aim of modernist political ideology.)

The answer to the question of why some cities degraded whereas others have grown relies upon design and construction priorities. Conceiving the environment in terms of simplistic industrial geometries ignores socio-geometric Living Patterns. Those, in turn, link to social and behavioral patterns, which are responsible for the life of the city.

CONCLUSION

Showing how architecture and urbanism are essentially tied to Living Patterns breaks a suffocating stranglehold that ideas of style have had on Architecture since the 1920s. Despite all the specious rhetoric declaring that Architecture was responding to profound social, political, and scientific discoveries, it in fact was driven by a rather narrow agenda, obsessed with style, and used to promote a small group of people in power. The road to achieving hegemony was through the imposition of a certain identifiable style that had nothing to do with human needs and sensibilities, but everything to do with successful marketing and the clever use of advertising techniques. Its phenomenal success is due to the continuous mutation of the original industrial style so as to appear forever "innovative".

Technocrats now in charge wield the power to alter our environment drastically for better or for worse. Design and building treated as an exercise of imposition and intervention, without any possibility for the system to respond, degrade the life of the city. Decision-makers expect people to conform to whatever spaces are designed for them—just as these people park their cars in designated spots in the landscape's ubiquitous lots and

garages. A trillion-dollar extractive global industry supports this hegemony, trying to convince us that our fancy new buildings are wonderful. Anchoring this mechanistic outlook is the desire to dominate our environment in exactly the same way we control machines. To admit the validity of Living Patterns is to relinquish total control, yet this is precisely what enlightened developers and government agencies must do from now on.

Any discussion of this controversial topic leads immediately to polemics and nasty accusations. The public sees and hears a highly polarized architectural debate, whose acrimony confuses us without offering clarity as to which side is correct, and which side is practicing deception (or has foolishly deceived itself). The only way out of this recurring battle is to approach the subject with scientific detachment. That is the aim of the present explanation of patterns and their applications. The question can be settled by describing Architecture in biological and pattern terms. This approach removes us from the hollow rhetoric and confused vocabulary of contemporary architectural discourse, and keeps us fixed solidly on ideas and results that can be judged true or false by means of experiment.