

Brains, Hands, and Hearts: How Traditional Design Supports Health

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These notes contain the slides presented at the conference, now made available for general readers. Additional explanatory remarks are included for clarity, documenting the comments as the event unfolded plus the considerable discussion afterwards. The material serves as a reference for this talk, in lieu of a proper paper prepared for publication.

STARTING WITH BIOLOGICAL BEAUTY

Healing from beauty, versus anxiety and stress?

- People instinctively identify beauty with health because it's in our DNA
- — and ugliness with illness; no confusion
- Beauty “touches the heart” according to its healing effect felt in our body
- But society promotes the disinformation that anxiety-inducing objects are beautiful

From the very beginning, I'm anchoring a revolutionary revision in how we design the built environment on the controversial notion of “beauty”. It is to be understood that this refers to the biological experience of beauty, which has almost nothing to do with the usual discussions involving aesthetics, architectural/art history, and philosophy. All the arguments are supported instead by medical data and experiments.

Foundations of the design discipline

- → A new understanding of ornament
- → A new understanding of urban space
- Healing geometry links to our evolution in a natural environment
- Generates emotional nourishment and boosts immune responses

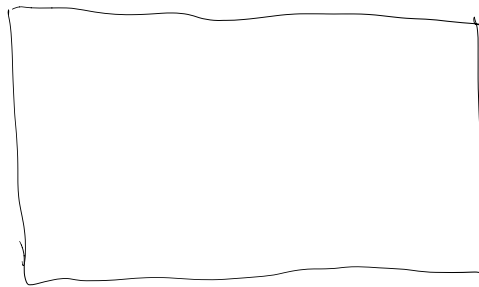
This talk proposes a revision of the way we conceive ornament on the one hand, and urban space, on the other. The break with the current mainstream approach to design is complete. These recommendations come from scientific research. Every concept links directly with human health, and identifies how that is influenced by the environment we experience. Design tools therefore aim to improve human health through environmental experience. As the recent film by Donald Ruggles “Built Beautiful” proposes, designing the built environment is now a matter of public health.

HOW TO VISUALIZE HUMAN ENGAGEMENT

Neuroscience proves human intuition

- Adaptive design is one factor of millennial traditions of healing practice
- **Engagement** is based on fractals and the inverse-power distribution of sizes
- Nested symmetries and ornament are additional factors supporting human health
- Eye-tracking reveals hidden subliminal reality

Bringing neuroscience into design is a formidable challenge for the discipline. Fortunately, recent technology has made the actual application very practical. Among tools that help to guide design are eye-tracking monitors, now available as a convenient portable apparatus. Even more practical is the simulation of eye tracking obtained from software analysis of scanned photos or drawings. This multiple toolkit enables us to visualize subliminal reality for the first time in history. Subliminal reality is what we actually respond to, which is entirely distinct from appearances.



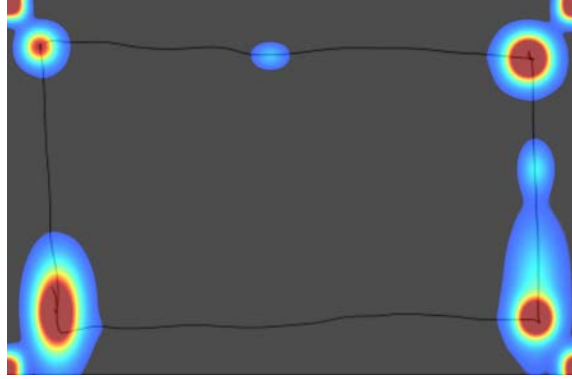
Eye-tracking experiments reveal a minimalist façade to be invisible to our unconscious

How many award-winning minimalist buildings look like this rectangle? Well, none of them register in our visual interest: for the brain they are simply not there. Our evolution prepared us to notice the geometry of places and objects in front of us that impact on our life and survival. We only react to potentially useful information. A construction presenting such an “invisible” aspect is irrelevant, except to block our view.

It is subliminal reality that affects human experience

- Our neural system reacts unconsciously to visual information in the first 3-5 seconds
- Visual contrast, curves, detail, and edges **engage** our attention for survival
- We don't “see” plainness — for our brain it's simply not of any interest for life

Everything happens unconsciously: subliminal reality shapes our responses, which prompt our actions. This is how the geometry of the environment influences our body and mind. Deliberate actions decided by conscious thought are entirely separate. Those can either harmonize with what is going on in our brain unconsciously, or the two mechanisms could clash. In the latter case, the body gets confused and stressed.



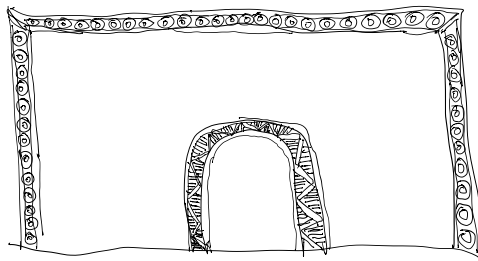
Use 3M's Visual Attention Software (3-5 sec)

Here the subliminal reality of the plain façade is plotted using color coding for clarity. Notice how the eye is deflected from the actual building, to focus on irrelevant points that are the corners outside the structure itself. The only thing we notice is where the building ends as it meets the ground on either side. We instinctively look to see whether there is something interesting behind this large thing. The structure itself is informationally irrelevant.

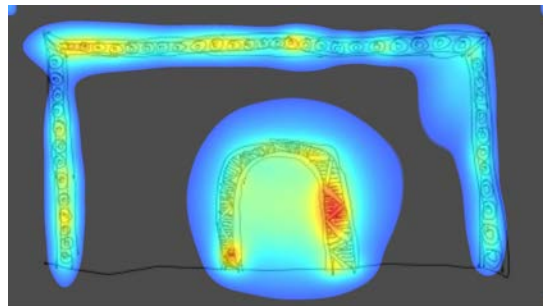
ADD SOME ORNAMENT

Subliminal reality and eye-tracking

- How the brain interprets our environment is never obvious from photos
- Organized complexity and elements of biophilic design determine **engagement**
- Map this easily through *Visual Attention Software* — *VAS* by 3M Company



To make a building noticeable, add ornament



We connect viscerally to the building through the ornament!

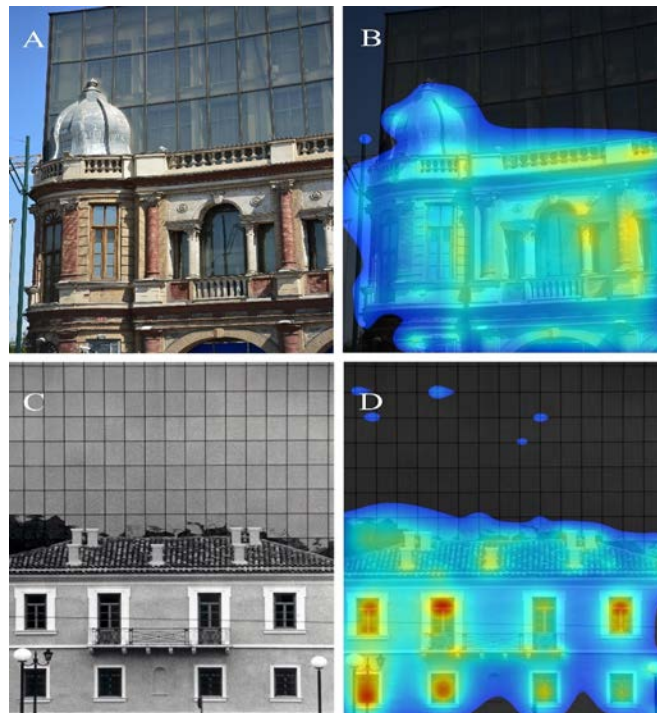
A technique known since the earliest humans: engage our attention and connect us with a physical structure by ornamenting it. Children know this, and billions of people in the developing world automatically ornament their living environments to make them more attractive, and more habitable. Only in technologically advanced societies is the above intervention on a building's façade forbidden by an entrenched bias. Our education system propagates that bias.

“Holes” and “hot-spots” in VAS

- (1) Empty regions — “holes” in the visual field — are ignored as wasted structure
- (2) A “hot-spot” draws our unconscious attention
- — but if its position is wrong, it's distracting
- When “hot-spots” do not focus, the material and subliminal realities contradict each other

The visual attention scans show three main features: empty regions, uniform blue glow, and hot spots. Empty regions do not register, as those contain no information. Where the eye focuses most shows as orange and red in the software's color-coding scheme. Exactly where such a hot spot is situated makes all the difference. Hot spots that coincide with the structure's logical focus help in comprehension; whereas hot spots situated in irrelevant places are not only useless, but distracting.

TRADITIONAL DESIGN ENGAGES THE BRAIN

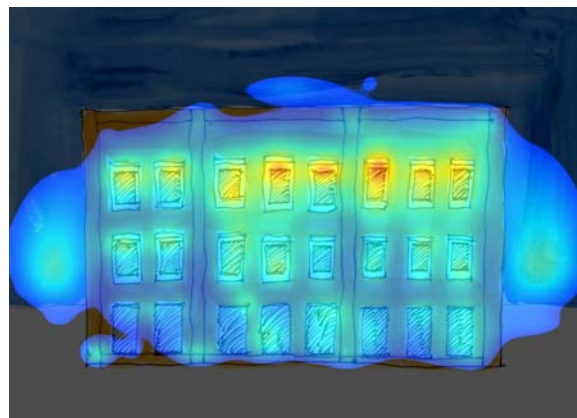


The eye ignores curtain-wall buildings behind the traditional buildings

These two photos (by Alexandros Lavdas) show a curtain-wall high-rise looming behind a traditional building. In each case, the eye totally ignores the giant building in the back, and focuses only on the visually-interesting building in front. The traditional building is covered with a uniform blue glow whereas the skyscrapers are merely empty regions in the visual field.

What's the point of architecture?

- Eye-tracking maps how buildings influence us, in a way determined by evolution
- It's the structure's organized complexity that triggers unconscious human **engagement**
- So, why build oftentimes huge structures that we don't "see" unless forced to look at them?
- Alexandros Lavdas, Nikos Salingaros & Ann Sussman, "Visual Attention Software: A New Tool for Understanding the Subliminal Experience of the Built Environment", *Applied Sciences*, 11(13), 2021.



Traditional building façade draws interest

A scan of a painting representing a building with traditional fenestration and window frames. Not particularly a great composition, but of sufficient interest to draw the eye's attention. We engage with this building because we find in its façade the geometrical elements our brain looks for: multiple nested symmetries reinforcing the vertical axis, a hierarchy of scales, etc.

We engage with the entire façade

- Gaze is contained mostly within the façade
- Repeating, symmetrically-aligned windows reinforce nested symmetries that **engage** our unconscious interest
- Coherent subliminal reality shows a uniformly-distributed "blue glow"

Points of visual interest are distributed throughout the more traditional façade, resulting in a "blue glow" (as coded by the 3-M VAS software). Empty regions in the visual attention scan become filled in, while any hot-spots become more uniformly distributed rather than being concentrated on one or two points.

The VAS scan becomes homogeneous

- As contrast, detail, and nested symmetries increase, visual attention spreads uniformly

throughout the figure's interior

- Subliminal reality evolves towards coherence
- **Engagement** requires *the opposite from homogeneity in the structure*

THE COHERENT COMPLEXITY OF NATURAL FORMS

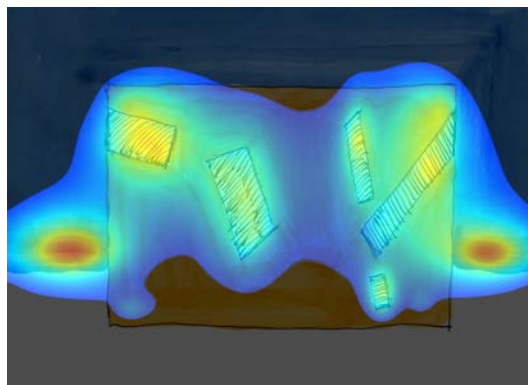
This is the first conclusion from the visual attention scans: the eye craves a particular type of visual complexity and does not notice minimalism. In what may at first appear paradoxical (but only because of decades of bias in artistic and design training), the more reinforcing structure that is added, the more uniform the subliminal reality becomes. Rather than turning into something that is visually jarring, a coherent detailed structure becomes unconsciously engaging.

Christopher Alexander's "field of centers" and "fifteen properties"

- The uniformly-distributed "blue glow" in VAS measures organized complexity
- In his *The Nature of Order* books, Alexander gives design tools for achieving coherence, now verified by neuroscience
- The "Fifteen Fundamental Properties" define the geometry of living structure

Twenty years ago, Christopher Alexander presented his findings on how to create an engaging subliminal reality. While he did not use those exact terms, he derived a sophisticated toolbox for achieving the organized coherence that is characteristic of engaging geometries. He called this quality "living structure". His remarkable findings, ignored by the architectural mainstream, contain a set of techniques for consciously achieving the desired state of engagement through sensitive design. Students are discovering those techniques and are learning them in the Building Beauty post-graduate program, the Biourbanism Summer School, or on their own. Many rely on my free online course "Unified Architectural Theory".

STRIVING FOR INCOHERENCE



The geometry of this façade deflects the eye

Little interest within an incoherent façade

- The eye is diverted off the edges on either side
- "Hot-spots" lie outside the building altogether

- Lack of reflectional, scaling, and translational symmetries **disengages** a person's gaze
- Deliberate violation of vertical axis — for “fun” — splinters the subliminal reality

Even though this building does not present an empty appearance, it still deflects the eye's main interest to beyond its edges. Within the façade, there is only a very weak attention to the corners of the top windows, but everything else offers little visual interest. I am well aware that this diagonal type of design is now in fashion, but will explain later why it is actually disengaging for our perceptive system.

Joint work with Alexandros Lavdas & Ann Sussman

- Evolutionary discoveries — such as mechanisms for **engagement** — are better left untouched!
- Nikos Salingaros & Ann Sussman, “Biometric pilot-studies reveal the arrangement and shape of windows on a traditional façade to be implicitly ‘engaging’, whereas contemporary façades are not”, *Urban Science*, 4(2), 1-19, 2020.
- Ann Sussman & Justin B. Hollander (2021) *Cognitive Architecture*, 2nd Edition, Routledge, New York, USA.

When we consider the time taken for evolutionary adaptation to derive mechanisms for animal and human survival, it seems crazy to attempt to erase them. Over millions of years, neurological circuits were built up as tools for unconscious engagement with our surroundings. That's how the human race thrived. If we respect the integrity of our own body's mechanisms, we have to try and not interfere with its evolution. Nevertheless, this brings us face-to-face with ideological and political movements that tried to do exactly that: social engineering aimed at creating a “new human being”, with altered behavior and even inheritable characteristics.

THREE DISTINCT TYPES OF COMPLEXITY

A mathematical interlude is instructive here, to discuss the three different types of complexity. Contrary to what is presented in the popular press, complexity is not a one-dimensional problem, i.e. high versus low complexity, but instead a two-dimensional one. Hence we have organized complexity, which is the type our brain craves, but also two separate and opposite types that disturb us. One is empty minimalism, and the other one is randomness.

How to distinguish among the three types of informational complexity

- VAS reveals **engaging** subliminal reality as a uniformly-distributed “blue glow”
- Two different and opposite types of geometry represent **disengaging** visual complexity:
- (1) EMPTY → **disengaging**
- (2) COMPLEX+RANDOM → **disengaging**
- Nikos Salingaros, “Adaptive Versus Random Complexity”, *New Design Ideas*, 2 (2), 51-61, 2018.

We have to input and decode environmental information to decide whether we need to approach something, to freeze, or to flee. High information coupled to high organization is easily comprehended by our brain, and contains a lot of useful content that we can immediately use. But

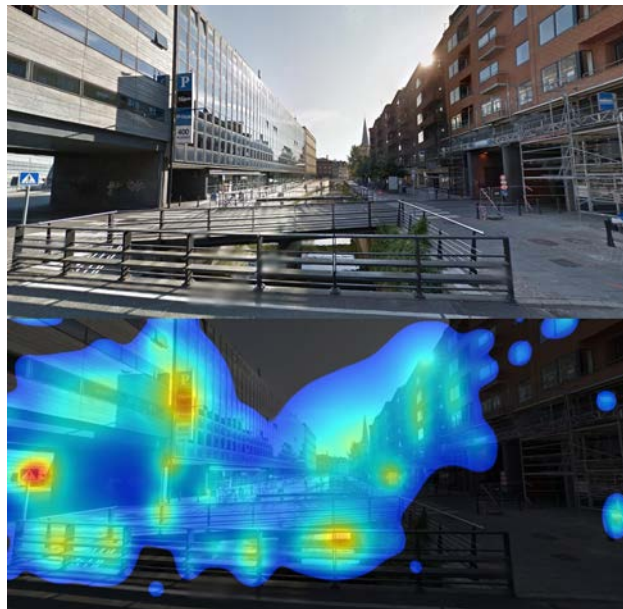
an empty, minimalist state contains nothing useful. Then, randomness contains a lot of disorganized information that overwhelms our cognitive system because it takes too much processing effort to input all of it. And there is usually no coded message in a random pattern.

HOW WE EXPERIENCE URBAN SPACE

A new understanding of urban space

- We perceive urban space the same way as our ancestors perceived the landscape of our emergence — with our body and “heart”
- Neurological studies imply that we should design the built environment with traditional typologies
- Nikos Salingaros, “Rules for Urban Space: Design Patterns Create the Human Scale”, *J. of Urban Research and Development*, 2(1), 4-16, 2021.

*Urban Space is felt viscerally, using all of our body’s perceptive apparatus. The feeling of belonging in a place depends on information from the surroundings, and has little to do with drawing a ground-plan of a plaza on a computer screen. Classical and traditional practitioners knew this complex and sensitive approach to designing public spaces, whereas the modernist and contemporary approaches ignore interactions to focus on abstractions (Nir Buras, *The Art of Classic Planning*, Belknap Press, Cambridge, Massachusetts, USA, 2020). The result is not very attractive in practice for the intended users. I refer to the design patterns of Christopher Alexander, which summarize essential rules for designing successful urban space. Those document the methods for achieving partial enclosure in a nourishing way that is not threatening.*



Disengaging hence useless urban space.

The visual attention scan of this pedestrian urban space reveals that the only things noticed are two commercial signs on the left. The ground, the building façades, the street wall, and the bridge prove to be of negligible visual interest. One hot spot occurs on the sky’s reflection of the water in

this dreary canal. Altogether, this is not a place that encourages pedestrian experience, nor walking through it. And yet it is representative of so many contemporary urban spaces that attempt to provide a pleasant pedestrian environment.

Real-world implications (with Aenne Brielmann, Nir Buras & Richard Taylor)

- Quasi-instantaneous perception cycles inform people's direction and speed of ambulation
- Having to consciously and continuously force our body to navigate industrial-modernist urban design is an engine for generating stress
- Anne Brielmann, Nir Buras, Nikos Salingaros & Richard Taylor, "What happens in your brain when you walk down the street?", *Urban Science*, 6(1), 3, 2022.

A recent paper outlines the neurological mechanism that encourages a pedestrian to walk in a particular direction. In traditional urban spaces, engagement affords movement in many different directions. But in industrial-modernist open spaces, we unconsciously perceive a hostile environment that disengages us. We therefore have to force our body to walk in a particular desired direction, and this action generates stress during the entire time we spend in that place. Ordinary walking is no longer a pleasure, but has become an emotionally-exhausting chore.

An inconvenient truth about the building and design professions

- Since World War II, we have been building in a manner dissociated from the brain's needs, causing anxiety and stress
- Signature buildings are not about humans, but to extract profit at the expense of the city
- Michael Mehaffy & Nikos Salingaros, *Design for a Living Planet*, Sustasis Press, Portland, Oregon, 2015

I am presenting these results in a professional conference, yet common people feel them intuitively. We have to deal with a massive public relations campaign praising inhuman buildings and urban interventions that only profit special interests while ignoring human feelings. This confuses the public, because the message contradicts what people understand unconsciously. Yet the force of authority tends to override trust in one's own emotions and erodes self-confidence.

Society smugly accepts the anti-city

- Design professionals remain ignorant of the rules for **engaging** with urban space
- Open pedestrian space was erased
- Even where pedestrians are allowed, including suburbs, space is hostile → the anti-city
- Nikos Salingaros, "Fractal Art and Architecture Reduce Physiological Stress", *J. of Biourbanism*, 2, 11-28, 2012.

The history of planning in the 20th Century recounts the relentless replacement of pedestrian spaces by vehicular streets so as to accommodate fast-moving traffic and parking. Coupled to this radical physical transformation, Euclidean zoning tore cities apart into separate monofunctional regions. When the car replaced the pedestrian, the intimate experience of urban space was no longer deemed important. One experiences information from inside a car very differently from a pedestrian. For this reason, even suburban public space is totally deficient because it does not provide an engaging informational experience.

ARCHITECTURAL THEORY BASED ON MATHEMATICS

It is now time to introduce the new architectural theory. So far, I have described diagnostic tools that are invaluable in evaluating buildings and designs before and after they are built. Those experimental monitors utilize results gained from medical and neurological data. But the actual theory of adaptive design is based upon mathematics, a research project that has been underway from before the latest medical and technological developments. A group of researchers, including Christopher Alexander and myself, has investigated the geometries that define healing environments. This body of work replaces texts that have hitherto been labeled as “architectural theory”. A genuine theory of something has to have both explanatory and predictive power. Architectural theory needs to explain the effects of the built environment on all people. Only then can a theoretical framework provide useful input into the decision-making process of architects.

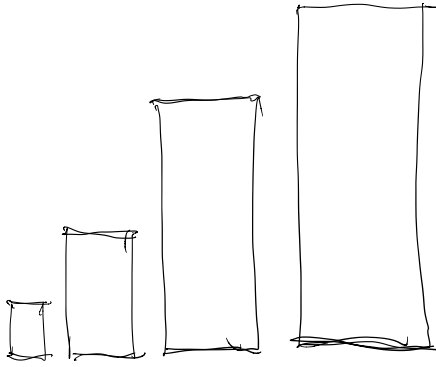


Introducing fractals: natural fractal structure

A fractal has nested structural scales

- Fractals combine sub-elements of many different sizes
- There is complex structure at every magnification, all the way down
- But if something is defined exclusively on ONE or TWO scales, then it is not a fractal!

One immediately sees structure on many different scales in this sketch of a natural fractal. Successive magnification continues to reveal complex structure. In an exact mathematical fractal, a similar pattern is repeated on different scales. In a true fractal, whether approximate or exact, the component pieces range over a hierarchy of sizes.

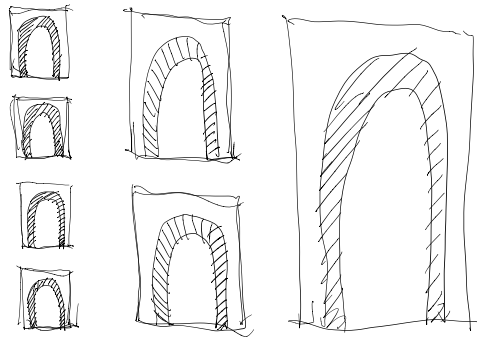


Different scales in a fractal link together through similarity

Scaling symmetry, or similarity under magnification, links distinct scales (sizes) mathematically and visually. In idealized cases, the same shape is repeated at different sizes, and these copies are combined into one self-similar whole.

Independently of scaling, the “Universal Distribution of Sizes” holds

- The smaller an element is, the more copies of it are present
- The distribution of sizes is an inverse-power law, just like in animal ecosystems
- All fractals and stable complex systems (nothing to do with fractal shapes) obey this rule
- Nikos Salingaros, *Principles of Urban Structure*, Sustasis Press, Portland, Oregon, 2005.

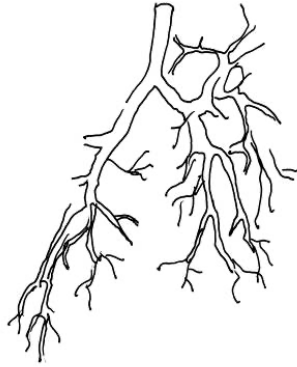


More copies of smaller elements are needed for mathematical balance

This is another key feature of a fractal: it contains more smaller components, and the smaller, the more numerous they are. Again, the whole fractal combines all of these components together into a coherent composition or structure. But getting rid of the smaller pieces destroys the fractal structure, which is what happens when imposing minimalism. Animal ecosystems and artificial complex systems obey the same distribution of sizes: the internet and electrical power grids, for example. In an ecosystem, big animals are scarce, intermediate-size animals more abundant, whereas bugs and bacteria are incredibly numerous.

Scaling symmetry in perfect fractals

- The smaller components are similar to the larger pieces
- They look the same after magnification
- The brain processes recursive patterns much faster than non-recursive ones — a huge survival advantage!



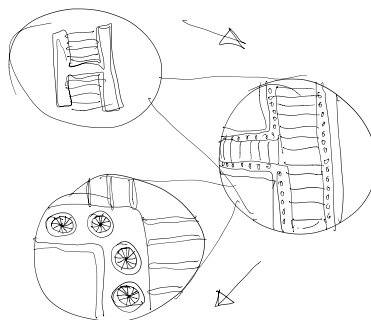
Hierarchy of scales in the human lung

The world of plants is essentially fractal: trees, branches, leaves, veins in the leaves, etc. Because of locomotion, animal bodies have to be more compact. Yet animals are also fractal on the inside. A surgeon opening up the human body sees multiple fractals. Independently of animal or plant physiology, however, our cognitive system profits from fractal image compression. A complex image can be grasped more easily if it has scaling similarity and fractal properties.

HANDLES AND TEXTURE FROM FRACTALS

Materials make a difference

- Plate glass, steel beams, and titanium sheets deny connection to brain, hand, and heart
- Yet natural materials and textures are now discarded in favor of “high-tech” materials
- *Contemporary architecture invariably chooses materials that LACK fractal qualities*
- Richard Taylor, “The Potential of Biophilic Fractal Designs to Promote Health and Performance: A Review of Experiments and Applications”, *Sustainability*, 13, 823, 2021.



A “statistical fractal” has complex structure at every magnification, without self-similarity

Whereas mathematical fractals have perfect scaling symmetry, natural and biological fractals may only be approximately similar under scaling. It doesn't matter, since the universal distribution of sizes still holds true, as successive magnifications reveal more and more detailed complex structure. Richard Taylor has described how biophilia links to fractals, hence to healing properties that the environment potentially has for its human users.

Hands grasping for the smallest scale

- To be “situated” in their environment, animals experience tactile and visual organized detail
- The eye needs small-scale complexity that offers reassuring handles for object affordance
- Graspable handles close to or on surfaces, where we can sit and stand next to them
- Nikos Salingaros, “Why we need to ‘grasp’ our surroundings: object affordance and prehension in architecture”, *J. Architecture and Urbanism*, 41(3), 163-169, 2017.

Now that we are talking about different scales present in our surroundings, there is a specific scale that the hand feels it can comfortably grasp. This might be an actual 3-D molding, object, or railing that is graspable, and situated where it is approachable. Or it could even be a well-defined design of the right size and shape that could be “grasped” only in the mind’s eye. In a fractal composition, such a scale would naturally be present. But not in a minimalist environment.

Contemporary and modernist design eliminate graspable handles

- “Contemporary style” means erasing graspable and virtual handles from a building
- This action contradicts the affordance effect that *engages* the brain with its surroundings
- Especially devastating for children, it blocks the interactive cycle that trains human cognition
- C. Raymond, M. Kytta & R. Stedman, “Sense of Place, Fast and Slow”, *Frontiers in Psychology*, 8, 1674, 2017.

I'm pointing out the design practice of deliberately erasing graspable “handles”, all the while giving the excuse of stylistic purity. An increasingly important philosophical discipline is today referred to as “The extended body concept”. It began with the work of Andy Clark and David Chalmers, who suggested that the human mind extends outside into its perceived environment. This idea links to the affordance theory of James Gibson. Today, many eminent researchers such as Iain McGilchrist are developing these concepts further. Mechanisms of situatedness are considered central in new theories of how children’s intelligence develops. An abstract style, in effect, cuts off all of the forces contributing to the extended body field.

BIOPHILIA AND THE HEALING INDEX

The Biophilic Healing Index includes “Fractals” as one component

- In addition to live plants, the brain craves:
 - — Color (contrasting, harmonious, intense)
 - — Curves (on small, medium, and large scales)
 - — Detail (meant to attract the eye)

- — Organized-complexity (nested symmetries)
- — Representations-of-nature

I proposed the Biophilic Healing Index, consisting of 10 components, as a quick way to estimate the healing effect coming from the built environment. You estimate their individual presence, then sum those values to get the Index. What I want to say here is that fractals and other purely mathematical qualities play a role alongside strictly natural qualities such as the presence or representations of plants and animals, sunlight, and water.

Alien design minimizes healing effects

- Without “Color”, “Curves”, “Detail”, “Fractals”, “Vertical Axis”, “Representations-of-nature”, and “Organized-complexity”...
- — the *Biophilic Healing Index* can be at most 30%, coming from plants, sunlight, and water
- Nikos Salingaros, “Neuroscience experiments to verify the geometry of healing environments: Proposing a biophilic healing index of design and architecture”, Chapter 4 in: Justin Hollander & Ann Sussman, Eds., *Urban Experience and Design: Contemporary Perspectives on Improving the Public Realm*, Routledge, London, 2020, 58-72.

The Biophilic Healing Index answers the question of why a building with lots of natural light is indeed healing, but could be depressing by every other measure. It's because sunlight is only one of the 10 biophilic factors. Curtain-walled buildings containing many potted plants can raise the healing potential up to 20%, and, if there are pools or running water, up to 30%. But that's it. To go even further, you need to introduce traditional design elements into the structure itself.

Post-operative healing in hospitals

- Post-operative recovery is improved by view of real trees from hospital room window
- Pioneering study established Biophilia as a major factor in human health
- — fewer days spent in hospital, and smaller doses of pain medication required
- Ulrich, R.S. “View through a window may influence recovery from surgery”, *Science*, 224, 417-419, 1984.

The pioneering study on healing environments was performed by Roger Ulrich back in 1984. Only the Swedish government paid attention, subsequently legislating that all new hospitals be required to follow biophilic design guidelines. In the US and UK, however, the accepted template for hospitals continues to be the Fagus Shoe-last Factory, simply copying the irrelevant 1913 design by Walter Gropius. This icon of Industrial Modernism provides a more lasting and powerful image of healing, even though it's bogus.

FACES AND SYMMETRIES ABOUT THE VERTICAL AXIS

Vertical axis is necessary for animals

- Ambulation uses gravity to move body forward
- Bilateral symmetry is a basic animal trait
- Eyes scan a scene horizontally from side to side
- Inner ear senses the gravitational axis

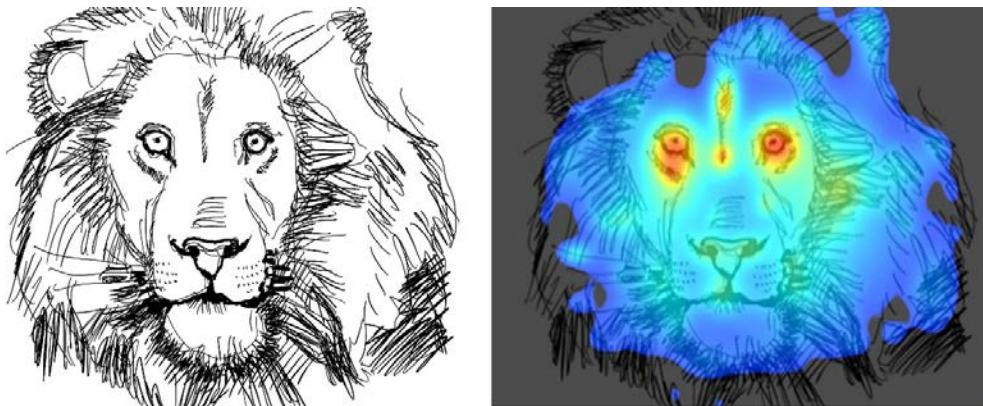
- The brain processes stimuli much faster around a vertical axis — neurological “oblique effect”

The vertical axis is embedded in the animal body, and in the sophisticated mechanisms of how it perceives its environment. Humans are no different. Deliberately stressing the human cognitive system by building non-balanced diagonals as a design innovation has serious negative consequences on human health.

Face-recognition cells in the brain

- Human perception is fine-tuned to **engage** other people emotionally
- Specific neurons recognize details and the bilateral symmetries of an upright face
- Interpreting animal and human expressions can mean life-or-death for the observer
- Donald Ruggles, *Beauty, Neuroscience, and Architecture*, Fibonacci Press, Denver, Colorado, USA, 2018.

Starting with simple verticality and going beyond that in complexity, the brain has specific innate face-recognition mechanisms. Facial recognition begins from how the baby recognizes its mother and other family members. This ability extends to the specificity of interpreting expressive facial nuances, which forms part of human innate intelligence. We “read” faces carefully in our search for a suitable mate. The “reading” of faces also comes in useful for confronting other animals. Eye-tracking studies reveal that we use exactly the same apparatus to interpret the faces of cars, building entrances and façades, etc. Car manufacturers are very much aware of this.



The lion’s intentions can only be read from details of his expression

A visual attention scan of this sketch of a Lion’s face shows how the design of the face attracts attention to the most important parts: the eyes and the brow.

ORNAMENT IS A NECESSITY

Our brain is hard-wired for ornament

- Bilateral symmetries of faces
- + ordered detail needed for our survival
- + fractal scaling imprinted from evolution

- + other Biophilic elements
- = ORNAMENT, which we sketch naturally
- Mark Hewitt, *Draw in Order to See*, Oro Editions, 2020.

When we combine biophilic elements, the smaller scale becomes ornament. The naturalness of ornament reveals itself when we sketch something organic by hand, a process that links the motor skills of the hand to the processing by the eye-brain system. Mark Hewitt discusses how the process of design is unconsciously enhanced by hand-drawing. It is most unfortunate that this skill is no longer considered important, since architectural graphic software tends to restrict the design freedom possible when drawing by hand.



Biophilia — the love of life — grows ornament, even if it is abstract

Another false myth used to suppress texture and ornamentation in interiors is to claim that shiny and smooth surfaces are more sterile. As we now know after extensive studies during the Covid-19 pandemic, pathogens survive on all sorts of surfaces to varying degrees. The only exception is exposed copper (along with its alloys brass and bronze), because the metal itself has antimicrobial properties. But like other invented narratives that entered the public's perception in the 1920s promising a better, healthier future, this one was based purely on appearances. This misunderstanding boosted the “machine aesthetic”, helping to propagate it universally.

A new understanding of ornament

- Children instinctively ornament their environment to make it **engaging**
- But contemporary architects introduce building details with an alien geometry
- This **disengaging** type of design is misleadingly called “ornament” — simply because it’s on the smallest scale

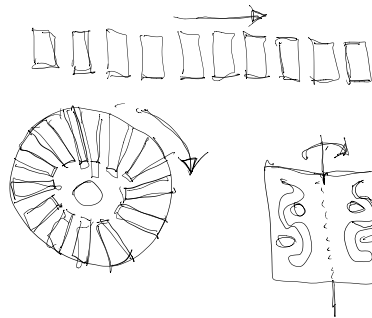
Simply because applied decoration may be added on the smaller scale to “spruce things up” doesn’t mean that it constitutes effective ornament. A design that purposely avoids the elements of engaging geometry will achieve its result: to disengage. If this is created on the scale where ornament would enhance a structure, incoherence is merely continued into the smaller scales. But true ornament is easy to create: hence this refusal to generate it must be due to the institutional interdiction of organic ornamentation. There is a fundamental misunderstanding with the purpose of ornament, which has nothing to do with a single scale.

INTELLIGENCE IS INTIMATELY LINKED TO ORNAMENT

Engaging ornamentation is a manifestation of animal intelligence

- Birds and fish use ornament, especially in sexual display — actually building ornamented nests
- Distinct from unintentional ornamentation of the body due to genetic coding
- Bees and termites build sophisticated homes, but the far smarter octopus deliberately ornaments its garden (The Beatles' song!)

Architects who have bought into the anti-ornament prejudice will be surprised to learn that ornamentation goes back in evolution to long before humans. The male Bowerbird uses brightly-colored found objects and pieces to create an ornamented nest and surroundings. This display of ornamentation attracts the female to mate with him. Male Pufferfish (Blowfish) engage in similar architectural activities, again for courtship display. The animal's ornamental abilities guarantee the species' survival. Here I'm referring to deliberate ornamentation using intelligence and not biological ornament, such as the Peacock's tail, which is an expression of the animal's genes.



Translational, rotational, and reflectional symmetries combine in organized complexity

It is regrettable that our society has lost its basic understanding of symmetry, usually assuming that it means an overall bilateral (mirror) symmetry. But that's the least important of all the possible symmetries in a composition or structure. What I'm talking about are thousands or even millions of nested sub-symmetries, combining different symmetry types on distinct scales, all in a coherent manner. Those were built up step-by-step in traditional architecture without much effort.

Symmetry-deficit disorder

- Does “symmetry-deficit disorder” lower a child's intelligence?
- The brain developing in a minimalist environment becomes insufficiently wired
- Smaller cortical mass is found in fish and mice
- Michael Mehaffy & Nikos Salingaros, “Intelligence and the Information Environment”, *Metropolis*, 2012.

Classic experiments found decreased brain size in animals raised in minimalist environments. Those results have been ignored by the architecture profession. An essay I wrote with Michael Mehaffy in 2012 made no impact whatsoever, as built environments meant for children continued to be dictated by industrial-modernist stylistic preferences. Calls for experiments to determine the

precise effects of environmental geometry on children’s development were not deemed important enough to be funded. Perhaps we are faced with the phenomenon of “cognitive dissonance”: when a result is too disturbing to confront, we resort to ignoring it, and trust that accepted authority would surely have checked it out if there were indeed such an extremely serious problem.



We connect to geometrical structure through details

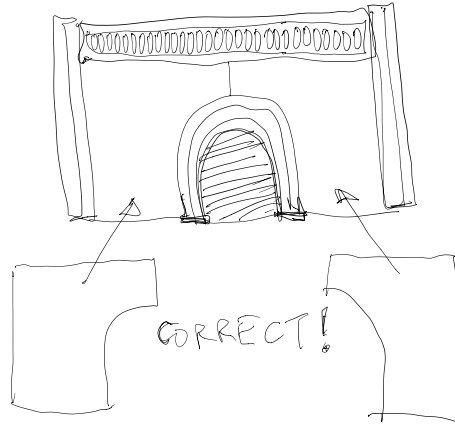
A child’s developing brain

- Develops 75% of its mass after birth
- Connections strongly influenced by sensory input
- New data reveal an alarming IQ deficit
- Is it due to the lack of environmental stimulation for children born during COVID-19?
- M. Aresta & N. Salingaros, *Challenges*, 12(2), Article 27 (2021).
- A. Lavdas & N. Salingaros, *Challenges*, 12(2), Article 28 (2021).

In what could become the medical tragedy of the early 21st Century, significantly decreased intellectual and motor development was noted for babies born during the Covid-19 pandemic. While a cause is not yet ascertained for this effect, nor has all the evidence come in, the implications are frightening. With my coauthors, I conjectured that one possible factor could be the minimalist environments that people raise their children in nowadays. This “symmetry deficit” is brought into sharp focus ever since families with young children have been isolated from external visually-enhanced environments, including exposure to the natural outdoors.

ORNAMENT IS PART OF A LARGER FRACTAL

A few words on how to apply these insights to create ornament for today’s buildings. The purpose of ornament is to engage the user unconsciously, so that the whole composition or structure feels emotionally comfortable. An absence of ornament is felt as an indefinable lack, despite the constant media bias promoting design minimalism. The opposite situation, where ornament is badly designed, is clashing because it is incoherent, and this clash attracts our conscious attention. Successful ornament is harmonious and never triggers conscious analysis.

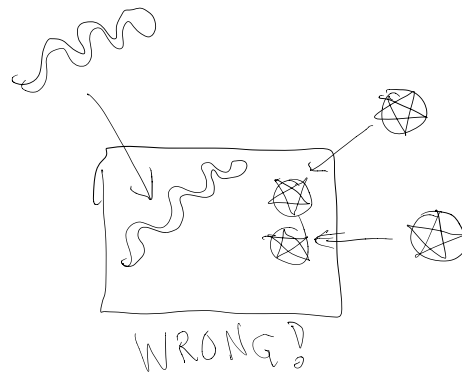


Design “from the heart” begins with organic ornament, then fills in the form

Since ornament lies at the basis of the process of engagement, it makes sense to treat it as an organic part of the whole, rather than adding it as an afterthought. As soon as architects and designers develop a new appreciation for ornament, they can create a conceptual framework that privileges it after so many decades of suppression.

But pasting incoherent ornament onto a form does not lead to engagement

- Our brain ties small, intermediate, and large scales into a coherent complex geometry
- *Ornament defines the smaller scales of a fractal encompassing the whole structure*
- **Disengaging** “ornament” is NOT part of a fractal, and denies unconscious attachment



Adding ornament unrelated to complex form betrays an ignorance of nature

Arguments against ornamentation inevitably use examples of poorly-conceived and executed ornament, where an irrelevant design is pasted onto a structure. The resulting visual clash is not pleasant. This unfortunate situation is common, simply because traditional techniques of generating coherent ornament have not been taught for decades, and therefore ornamentation today is a hit-and-miss affair. But this insufficiency should not be used to condemn ornament; only to argue for proper education and better training towards producing it.

INSTITUTIONALIZED SOCIAL ENGINEERING

Ideologically-motivated suppression of ornament is a crime against humanity

- Architecture schools implement Lamarckian social engineering
- Psychological conditioning eliminates our ability to *engage* with the world
- A determined but futile attempt to change human DNA in an evolutionary regression

Lamarckian evolution is the notion that a forced change on organisms' bodies or of their behavior will be imprinted into their DNA, hence will be inherited by their offspring. This doesn't happen. Conditioning and imprinting work only on the individual, but are not inherited traits. Ignoring this scientific fact, social engineering tries to condition architecture students to reject the innate mechanism for engaging with their environment. This training can be quite successful in creating architects who are detached from the world. Society has been conditioned by the media to accept such a state as "normal". Nevertheless, the children of those indoctrinated individuals will naturally seek to create and take delight in color, curves, details, ornament, symmetries, etc.

Conclusion: design consequences from medical research

- A new blueprint for architectural theory informed by environmental information
- Accumulating findings distinguish which geometries keep people healthy — versus those that make us sick
- Scientific research proves that traditional architecture developed to boost our health

Simple explanations for why some architecture is healthy while other types are unhealthy are not embraced by the profession. High-profile practitioners (as opposed to the majority of architects who do modest projects) rely on branding and a personality cult, the promise of hidden design talent, and secret recipes to attract commissions. The industry doesn't welcome authentic scientific analysis and clinical trials because the results would obviously be disappointing, and would not help to sell products such as weird iconic buildings. It would also put at risk the unquestioned production of run-of-the-mill glass boxes worldwide. Industrial Modernism is apprehensive about losing its legitimacy.
