

A Vision for Architecture as More Than the Sum of Its Parts.

How modernist fundamentalism degrades the human and natural environment.

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Many research studies show a remarkable divergence between the way architects see their work and the way non-architects do — to such a degree that it is not uncommon to hear ordinary people wondering aloud how it is that architects, and architecture students, seem to want to make such strange and unpleasant buildings today.

A second, related perception is that, for many, the architecture of most human environments today is far uglier than what even ordinary people were able to make a century or more ago — and moreover, the latter places are often among the most beloved and enduring that the world has to offer. Why is this, many wonder? Is it just the price of progress? Does it even matter, really? (Especially since architects are responsible for a diminishing part of the built environment?) And is this issue connected to our daunting challenges of sustainability and resilience for the future?

We answer, in a word, yes.

In 2001 we wrote a short essay that introduced the term “geometrical fundamentalism” — a pervasive architectural habit of thought that, we suggested, helps to explain the historically unique patterns of much of modern practice of planning, design, and construction. These patterns in turn have carried with them profound and negative consequences. (That original essay has since been published in the book [A Theory of Architecture](#), and it’s also available on line [HERE](#).)

“Geometrical fundamentalism” is, we argued, a fervent ideological belief in the urgent necessity to denude the human environment of all but abstract, putatively “rational” forms, composed into one-off works of art — lines, planes, cubes, and the like — in the misguided belief that these are actually more advanced and “modern” — hence “Modernism”. (But as we will discuss, they are not more advanced, but in fact are dangerously primitive.) In that essay we only briefly referred to the origins of this peculiar but pervasive kind of fundamentalism, and its profound impact on today’s human and natural environment.

In this essay, we will dig deeper into the history of this enormously influential habit of thinking, and explore its origins in the evolution of contemporary planning and design theory. We will anchor this discussion within the broader development of industrial civilization, and the

distorting influence of its powerful incentives to industrialize the human environment, by inserting its own profitably expedient forms into an otherwise geometrically denuded environment. We will argue that architects in particular have become tragically corrupted by this industrialization.

In particular, a perennially dominant school of “modernist” architects, energized by a heady mix of economic power and quixotic idealism, became essentially co-opted by industrial interests. Their role in the new economic-industrial regime was to serve as fervent boosters of this denuding practice, by peddling a bogus marketing image of a utopian industrial future. Despite cycles of criticism and disavowal, their legacy continues unabated today, in the many “rococo” variants of modernist design.

In the process, architects became oddly blind to the many negative effects of their own work — a condition we have described elsewhere as “architectural myopia” (see “[The architect has no clothes](#)”). That condition helps to explain the vehement ideological rigidity of many architects and their cognitive bias toward objects over contexts — the same kind of bias that occurs in other forms of fundamentalism.

We conclude on a hopeful assertion: that real choice does in fact exist for a more bottom-up, evolutionary approach to planning and design, one that offers the basis of a new era of ecological humanism in architecture, at a time when such a reform is desperately needed.

The relation to “commodification” — and an unsustainable consumerist system

The story of geometrical fundamentalism begins with the origins of our “modern” system of technology and industrialization, about which we have written in more detail elsewhere (e.g. see “[The Geometry of Resilience](#)” in Metropolis magazine). This system has achieved many impressive results, to be sure: medicine, sanitation, travel, prosperity and much more. But it has left us with a colossal hangover — an unsustainable relationship to our resources, to our environment, and ultimately to each other. It is a truism — but nonetheless true — that if we are going to survive and be well in the future, we must fundamentally change our current “modern” model of technological growth, away from business as usual. That surely means we have to change the way we design and construct our human environment too.

Put differently, the ugliness and disorder of our present human environment is certainly related to the ugliness and disorder due to the damage we have created in the natural environment.

But how did the modern system of development and consumption — our “technological-consumerist” system — come about? Was it not an inevitable part of the evolution of science and technology, and an inevitable response to the desires of consumers — in short, our destiny?

No it was not. In fact this system was *invented* — planned by industrialists and political leaders in the early years of the 20th Century, primarily in the USA. The story was documented well in the 2002 film by BBC documentarian Adam Curtis, “The Century of the Self”, and in particular the first episode titled “Happiness Machines” (see <http://vimeo.com/61857758>). Leaders of Wall Street joined with political leaders to solve a twin problem: how to keep the masses engaged in productive and wealth-generating activities, which would also quell potential political unrest.

Their answer was to create a new kind of consumer society — the one we take for granted today, and the one that is still used to sell consumer products (including modern architecture in *Dwell* magazine, for example). This new idea was perhaps explained best in 1924 by Banker Paul Mazur of Lehman Brothers — the same company whose notorious collapse in 2008 helped trigger the global financial crisis and great recession. “We must shift America from a needs-culture to a desires-culture”, said Mazur. “People must be trained to desire, to want new things, even before the old have been entirely consumed. [...] Man’s desires must overshadow his needs.”

Central to this fascinating and poorly-understood story was Edward Bernays, a remarkably important and yet almost unknown figure in modern history. Bernays was the nephew of Sigmund Freud, and his brilliant idea was to use Freud’s own ideas on subconscious desires to create powerful new strategies for advertising, public relations, and propaganda. Among Bernays’ “accomplishments” was getting millions of women to smoke for the first time and essentially inventing the modern political campaign, with all its emotional manipulations. (Freud, to his credit, strongly protested this manipulative, exploitative, and fundamentally antidemocratic use of his ideas.)

Even less well known, Bernays played a key role in selling modernist urban and suburban planning to the public. As Curtis’ film demonstrates, Bernays helped to orchestrate the seminal “Futurama” exhibit by General Motors at the 1939 World’s Fair. It was this event, perhaps more than any other, that sold a radiant vision of the suburbia to come to a desperate public, traumatized by the Depression and coming war, and seeking a positive vision of the future. To this vulnerable audience, the marketers offered a gleaming new age of modern buildings and suburbs and consumer gadgets of every conceivable type. It was all so wonderful! We had certainly been “trained to desire, to want new things ...” And we got them.

And it was architects, working with industrialists like the leaders of General Motors, who led the charge. Here is the pioneering modernist architect Le Corbusier’s prescription for drive-through utopia, described in his pamphlet *Radiant City* (1935, translated into English in 1967):

The cities will be part of the country; I shall live 30 miles from my office in one direction, under a pine tree; my secretary will live 30 miles away from it too, in the other direction, under another pine tree. We shall both have our own car. We shall use up tires, wear out road surfaces and gears, consume oil and gasoline. All of which will necessitate a great deal of work ... enough for all.

Radiant urban sprawl

It is at this point in the story that some architects will protest: surely it is unfair to blame modernist architects for the ills of the built environment! After all, the American-style suburbs are full of pseudo-traditionalist schlock... we modernist architects are actually making the world more sustainable, through our new “green building” technologies; you can’t blame us!

We will have more to say about the merits of “green Modernism” below. But this pseudo-traditionalist schlock, so detested by many architects, is a mere thin veneer of marketing applied over the same stripped down blueprint for sprawl — the one created by modernist architects like Le Corbusier, based upon the fundamentalist concept of “the city as a machine”. Its segregated parts would combine mechanically, and would be connected by machines — specifically, automobiles, and the machine-like buildings that they moved between. If a little applied schlock

made the package easier for consumers to swallow, that could be easily arranged.

Today's modernist designers would love to disown the aesthetics of American-style suburbia, but the fact is that the industrial manufacturers of these mass-produced suburban environments loved the modernists' machine-minimalism. Not content merely to strip down the parts of the old cities into functional bits of machinery, they also stripped down the detailing of the buildings themselves. They made flat, clunky windows, deleted ornamental trim, eliminated connective outdoor spaces — and gleefully turned buildings into just so many manufactured boxes, packaged in decorative marketing gimmickry.

Of course, human beings were also treated as segregated bits of machinery. Would-be suburbanites were lured by the knowledge that they could drive far away from others who weren't like them, and live in large houses on large lots away from other people. They could always drive to the big-box stores for their growing consumer needs. Everyone would then produce a great deal of economic activity, make a great deal of money, and all would be well — until the unintended consequences took their devastating toll.

So the rapacious industrialization of the environment came packaged in a marketing campaign aimed squarely at consumers' deepest Freudian desires and fears.

Perhaps the most seductive marketing concept of all, on display to such powerful effect at the General Motors diorama at the 1939 World's Fair, was the allure of an exciting new technological future. This intoxicating "futurism" was a concept pioneered by Le Corbusier and other early modernist architects. Industrial behemoths like General Motors readily understood the seductive appeal of this exciting technological novelty — New! Improved!

But a related concept, no less attractive to General Motors, was that anything older — like old streetcar lines, or the streets and street-friendly buildings on which they ran — were intolerably old-fashioned. The streetcar lines must be bought up and demolished; the inner-city neighborhoods, with their tight walkable streets, must be abandoned.

Some twenty years later, General Motors captured this romantic spirit of industrialization perfectly in a rapturously futuristic television and film advertisement. An attractive couple glides through a dazzling modernist utopia in their rocket-like car, as the music plays:

Tomorrow, tomorrow, our dreams will come true!

Together, together, we'll make the world new!

Strange shapes will rise out of the night,

but our love will not change, dear —

It will be like a star burning bright,

lighting our way, when tomorrow meets today!

In the advertisement, the "strange shapes" that "rise out of the night" are buildings, and they are clearly avant-garde works of alluring fine art. This was yet another example of a potent marketing combination. If fine artists were now in unquestioned service to promoting industrial

products, well, that was surely progress in modernity. Such work could thus also be placed within the honored tradition of great architects of the past — however much it actually rejected most of that design legacy. With this combination of product marketing and avant-garde art in service to industry, modernist design took a commanding hold over consumer consciousness — and over the power-brokers of civilization.

Thus was born a powerful alliance that continues to this day — and continues to obstruct, except in mechanical and tokenistic ways, the needed revival of walkable street-based urbanism. Le Corbusier said we must embrace an exciting future, and to do so we must “kill the street” — and he was remarkably effective in doing so. General Motors, too, said we must embrace an exciting future, and to do so we must kill the streetcar, and the “old-fashioned” world in which it existed. GM too was remarkably effective, fueling the massive destruction of inner-city neighborhoods, and the streetcar systems that served them.

It must be said that this regime did in fact work extraordinarily well, in the limited sense of an economic development strategy centered on the industrialization of the built environment, and the merciless denuding of the built environment according to geometrical fundamentalist ideas. But the model, economically a riotous success, now leaves us with a looming global crisis of extraordinary proportions. Le Corbusier could perhaps be forgiven for not knowing about climate change, resource depletion, or the complex dynamics of good cities. Today, however, we have no such excuse.

Origins of Geometrical Fundamentalism

Why did Le Corbusier and other architects come to believe that this denuding of the complexity of the environment was necessary and even wonderful?

The story goes back to the early days of the 20th Century, when many people were desperate to escape the horrors of the 19th Century. Artists were exploring radical new forms, and political groups were exploring new ideas about social organization. At the same time, industrial technology was rapidly changing.

Architects, eager to be part of this emerging new order, began to make connections between the changes in art, politics, and technology. Perhaps they could be the artists who made sense of this new world order? Perhaps they could actually help to usher in an exciting new age?

Nevertheless, by today’s standards, those promising changes in technology were primitive. They relied upon standardization, replication, and stripped-down forms — the only ones that were possible with the relatively crude technology of the time. (Henry Ford famously said, “you can have any color of car you want, as long as it’s black.”)

Some people found this disturbing. But in 1908, a young architect in Vienna, Adolf Loos, wrote a highly influential article that turned this concern on its head. Are we alone unable to have our own style — to do what “any Negro” [sic], or any other race and period before us, could do? Of course not: because we are more advanced, more “modern”, *our* style must be the very aesthetic paucity that comes with the streamlined goods of industrial production — surely a hallmark of advancement and superiority. In effect, our “ornament” would be the simple minimalist buildings and other artifacts themselves, celebrating the spirit of a great new age.

The “Papuan”, Loos argued, had not evolved to the moral and civilized circumstances of modern man [sic]. As part of his primitive practices, the Papuan tattooed himself. Likewise, Loos went on, “the modern man who tattoos himself is either a criminal or a degenerate”. Therefore, Loos reasoned, those who still used ornament were on the same low level as criminals — and Papuans.

Built on an essentially racist worldview, Loos’ watershed essay inaugurated a pervasive fallacy about the alleged connection between minimalism and modernity: here indeed was the seminal birth of geometrical fundamentalism.

Loos’ influence was codified in his most famous dictum, “ornament is a crime”.

Loos’ naïve mistake, perpetuated by those who came after him, was to suppose that geometrical minimalism is an intrinsic virtue. It *can* be a virtue, when other added elements would create disorder. But more often we face the opposite problem: a minimalist pattern is incomplete, and it requires very specific additional components to generate coherence. The view of modern physicists and mathematicians might be most helpful in understanding when a geometric pattern can be simplified, and when doing so would damage its essential structure. The rule is best summarized by a famous remark by Albert Einstein: “*Make everything as simple as possible — but no simpler.*” When it comes to biological systems — including human environments — that level of simplicity is often surprisingly complex.

In the century since Loos’ slogan was blindly adopted, great progress has been made in the mathematics of complexity. We now know about the vast complexity of “irreducible systems”, which nonetheless can be generated by — but not reduced to — simpler algorithms. Much of the biological complexity of the world is in fact “computationally irreducible” — that is, it may be generated from a simple algorithm, but the only way to accurately express the structure is to actually run the algorithm completely. The world, it seems, is not reducible to a minimalist schema. And we are all the richer for it.

However, as the philosopher Alfred North Whitehead famously noted, we humans have a dangerous tendency to over-simplify the world, and to confuse our own simpler models for the true complexity of life. He called this error “the fallacy of misplaced concreteness” — a confusion of our abstract models of reality with reality itself, leading to over-simplifying actions that are life-damaging.

Christopher Alexander made a similar observation when he argued famously that “[a city is not a tree](#)”— that is, it is not a simple hierarchical structure, but in its complex geometrical relationships, it has important forms of overlap and redundancy, which the human mind finds difficult to grasp. We like to over-simplify the world into neat “tree-like” schemes — but in turn, when imposed on real cities, these schemes can go on to produce enormous damage to the physical structure. This, in fact, is the tragedy of the Twentieth Century, in dozens of cities around the world.

Worse, architects replaced their concern with the real aesthetic expressions of healthy places, with the abstracted, commodified qualities of aesthetics-for-aesthetics’-sake, enjoyed by an élite of self-proclaimed connoisseurs. When this practice damages the environment, then something on the order of professional malpractice is occurring — nothing less.

In the realm of science and mathematics, by contrast, our geometric science has been

enormously enriched by insights into the complex geometries of nature. We now understand the vastly complex fractal patterns all around us, and the iterative, “algorithmic” processes that generate them. We understand the often-chaotic behavior of “attractors”, and the way they form clusters in regions of evolutionary solution-space — structural configurations representing Christopher Alexander’s idea of “patterns” (see below).

We also understand more about the “biophilic” reactions that human beings have to such patterns in their environments — probably because humans have evolved to make sense of such a world of complex yet ordered form and process. We are beginning to appreciate that people crave an information-rich environment, and through the course of their lives in a city need more than a series of solitary experiences of art composed according to arbitrary abstract criteria.

Architecture becomes industrial marketing

Another key event in the evolution of geometrical fundamentalism began around the same time, in the office of the German architect Peter Behrens. [We are relying here on our article [“How Modernism got square”](#) in Metropolis magazine.] Now known now as “the father of corporate branding”, Behrens touted industrial minimalism as an aesthetic tool to create a streamlined marketing image to help his client AEG (Germany’s version of the U.S. company General Electric) sell its products. To do so, he created striking logos, stationery, advertisements — and buildings, which, in effect, were converted into giant billboards to help to sell companies and their products.

In taking this momentous step, Behrens was masterfully solving a critical problem for environmental designers in a new age of standardization and mass production. If we were no longer going to generate the form of buildings in place, through localized, craft-like processes, and rely instead upon (supposedly superior, and certainly cheaper) combinations of standardized parts, then how were we as designers going to create aesthetically distinctive works? The answer he gave was: by “theming” them with an exciting stylized vision of the future, to be created by industry (and specifically, by the client company and the design firm).

So would thus buildings and other objects into canvases to “brand” our companies, our firms, and our own talents as visionary designers. More than that, these packaged designs would have the special allure, in the skilled hands of Behrens and his artistically minded protégés, of a great new fine art.

The image that Behrens created, working from the self-imposed limitations of this new aesthetic minimalism, was of power, industrial might, order, and cleanliness. Above all, it was the promise of a wonderful new technological future. Behrens was the first to realize that an intoxicating vision of the future can be used as a powerful marketing tool. It is the selling of a hope, a dream, a desire — even if it is one that is destined to quickly tarnish and be discarded. (Actually, all the better; such planned obsolescence means another “new, improved” product can be sold in its place.)

The seductive power of this futuristic message was not lost on three of Behrens’ young protégés, each of whom went on to have a profound effect on 20th Century design. Their names are certainly familiar to any architect today — in fact, almost all architectural students are required to study and copy them in school. They were Walter Gropius, Charles-Édouard

Jeanneret-Gris (later known as Le Corbusier), and Ludwig Mies van der Rohe. In the next decades they would announce their “total architecture” (Gropius) that signaled a “great epoch of industrial production” (Le Corbusier) and “the will of an epoch” that “less is more” (Mies).

The need for connective geometry

But as we have seen, that “unavoidable reality” is now looking like a recipe for an avoidable disaster. Moreover, from a contemporary scientific point of view, the whole approach was fundamentally mistaken in key aspects of its understanding of the nature of environmental structure.

The architect and design theorist Christopher Alexander has long made a similar point, from his first book [*Notes on the Synthesis of Form*](#), through to the more recent [*The Nature of Order*](#). He argues that there is a profound need to couple structures together into larger wholes — and a need to employ geometries that are able to do so. This “deep interlock” is a characteristic of natural environments, because it is basic to the generative effects of natural processes. But this characteristic is missing from the abstract, minimalist geometries of Modernism — with profound consequences. In the best modernist environments it might be compensated for in other ways — with plants, say, or other external decorative additions. But the structures themselves are greatly impoverished, and therefore likely to contribute to environmental disorder.

One of the ways that humans have provided this connective geometry necessary for life over the centuries is, in fact, through the use of ornament. In the book [*A Pattern Language*](#), Alexander and his colleagues give the example, in Pattern 249, of traditional ornamentation. This pattern might seem, to the eyes of a geometrical fundamentalist like Adolf Loos, superfluous and even “primitive” — but in fact, it serves an essential connective function.

Ornamental designs and structures in architecture actually serve to cement together components of different sizes as part of a larger geometric system. There are millions of examples in practice: beautiful traditional stairways, doorways, moldings, trim, window frames, etc. that are richly ornamented — and thereby connected to their environment. We could even stop talking about ornament altogether and instead focus on the essential connective geometry of an adaptive environment. The biologically-evolved human need of achieving connectivity in the environment is what generates ornament.

Geometrical fundamentalists would say that such detailing as is found in traditional ornament is primitive, or inappropriate to our modern tectonics, or that we are incapable of building with such authenticity and skill today, and any such effort will inevitably result in clumsy, inauthentic, insufficiently “creative”, insufficiently avant-garde art. Such sentiments betray an acutely reactionary aesthetic, rigidly fixated on a fundamentalist ideology and rooted in a century-old misunderstanding of modernity, before the discovery of new knowledge of the interlocking geometric patterns by modern complexity science.

The extreme confusion, false understanding, vicious partisanship, and near-religious fanaticism led many modernists to blindly condemn what it is that ornament represents. Otherwise intelligent writers state that ornament is “imitative of nature” — but this is a misleading backhanded compliment. Ornament is nothing less than human creativity expressed in its most direct and immediate manner. Ornament is simply the first step in the generation of

innovative structure towards achieving coherently complex forms. Almost every other positive human achievement points in the same direction, and arises from the same creative process.

Anti-ornament sentiments betray a hidebound *status quo* thinking about art, and — for all the claims to creativity and newness — a surprising lack of imagination. For it was the regime of Modernism that accelerated the destruction of the traditional culture of building, out of a misplaced hostility to the evolutionary power of tradition. Geometrical fundamentalism enabled nearly a century of stripping down, blanking off, and furtively adding back, as a sop to the market, only the cheesiest of token traditions. It very nearly destroyed the vast repository of knowledge of how to build beautiful, adaptable, enduring buildings, and gave us a world of failing junk.

To blame modern builders for being (presently) incapable of using traditional patterns well, in the wake of such an environmental apocalypse, is a self-fulfilling, self-reinforcing prophecy, and a willfully irrelevant conception of art. Helplessly accepting this loss betrays the opposite of imagination, and the opposite of a truly radical avant-garde. Current practice fails to understand that change is possible, and that choice is necessary.

But this is not really an incomprehensible state of affairs. A system of powerful rewards is in place for the indulgence of this profitable *status quo*, including jobs, commissions, careers, fame, and acceptance. There are the cognitive distortions of an over-specialized, insular profession — seeing every design problem as an opportunity to impose parochial predilections for a modernist aesthetic. An élite privilege of narrow aesthetic pleasures is rooted in an image-based approach to environmental form — and is, in turn, rooted in the marketing of aesthetic veneers, passed off to a gullible public as the miraculous qualities of a grand futurist vision.

Cooler, more sober heads from other disciplines and walks of life are recognizing the naïveté of this subculture, its history as a marketing invention of narrow special interests, and its role as an industrial enabler of a slowly unfolding global industrial disaster. The pressure is increasing on architects to behave more responsibly, and become engaged in the deeper reforms that are needed. It seems long past time for serious people to ask what must come next.

Integrating the functional and the aesthetic

Before we can discuss what might in fact come next, we need to explain a basic concept of the creation of form through design, following the complex processes of the natural world.

Broadly speaking, we can distinguish among three approaches to design. The first generates form as a means of achieving specific goals and solving technical problems — for instance, we make round wheels to accomplish the goal of horizontal movement. We can call that the “functionalist” approach. This is nuts-and-bolts design, focused upon what works mechanically.

A second (more purely artistic) approach to design creates a surface aesthetic experience as its goal, without much concern for deeper mechanisms and problems. This is what we may term an expressive approach. This second approach need not work well at all, from a functional point of view — it is design strictly for visual show, accepted because of image.

Many of the artifacts of modern design, from computers to houses, combine these two approaches in a mechanical way — for example, design engineers create the electronics of a

computer, and design stylists then create eye-catching cases that have little relation to the engineered parts inside. These outer shells, because they are specialized to have a certain look as objects, also have little direct relation to the other things outside the object being designed. The designs, which are usually mass-produced and interchangeable, do not embody any adaptation to particular structures at the larger scale outside.

This uncoupled functionalist/expressive approach can be termed “disconnected”. We simply “engineer” or “style” a form — or both, one over the other — and place the result in the environment, but without any real process to adapt the form to its specific context. Most of the designed goods in the world are made in this way today, because it is conducive to the dominant processes of standardization, replication, and mass production.

As a result, the form is freed from any deeper relation to its function, or to its adapted place in the world. It is now just a pure geometric expression, reflecting whatever happens to be the designer’s will at that moment. This is what has been accurately termed, with some scorn, as “willful” design. It carries the connotation of being contrived, arbitrary, even “fake”.

A kinder point of view proposes that a “disconnected” architecture is a form of metaphorical expression, and as such, is just like any other form of fine art. But of course, architecture is not like any other form of art, in that it has to serve as actual human habitat. Whether or not it is great art — and it is certainly *not* for the vast majority of designs so produced — the kind of form that results is usually very different from the vastly complex forms of nature, which are generated in a fundamentally different way.

The danger is therefore that artistic “magical thinking” will delude architects into thinking that, through their art, they have accounted for the needs of human habitat. If their art includes metaphors of sustainability, then it must be sustainable; if it includes iconic expressions of a great city, then the city in question must be great indeed; and so on. But a metaphor will rarely lead us to find the reality behind it; more often, it leads to deluded thinking.

There remains an intractable problem with the large scale in architecture — that the sum of these individual works of art is not greater than the parts. From such collections of “giant sculpture gardens”, disordered and fractured cities have grown (in stark contrast to the “organic” traditional city). Working within this paradigm, architects can only enforce a rigid and deathly visual order from above, and the result is fragmentation and dysfunction.

A third, much rarer approach to design (at least in the modern world) seeks to unite the functional and aesthetic requirements of design in a deeper way, using the adaptive problem-solving process itself (the process of “adaptive morphogenesis” as Christopher Alexander has described it) to generate integral aesthetic characteristics. In effect, this forms two sides of the same coin, and is also the way organisms achieve their great beauty and richness. In fact, what we experience as deep beauty is exactly this deep ordering — importantly in this case, extending beyond a single object into a larger environment.

It is noteworthy for us that biological forms achieve adaptive problem-solving in two intimately coupled ways: (*i*) they adapt to the structural problem to be solved — say, the shape of a wing for flight, and (*ii*) they *also* adapt to the need, where appropriate, for expressive communication between organisms. (We might think of the beautiful shapes of peacock feathers, or the extravagant colored patterns of toxic butterfly wings.)

At its best, human design seeks to achieve this third goal. But for several decades, it is hobbled by limiting itself to the crude technology of a previous industrial era, constraining its geometry to the simplest shapes and volumes in vogue at a particular historical moment in the early 20th Century (straight lines and right angles, empty planes, rectangles, cubes, cylinders, etc). Those forms were rationalized — incorrectly, from a modern mathematical perspective — as “purer” and more elegant, hence more “modern”, geometrical forms. This incorrect interpretation is clearly wrong, and has had catastrophic consequences.

The surprising return of ornamental patterning

What was not understood earlier — and what we now raise as a central point of this paper — is that *a crucial way that human beings have achieved adaptive morphogenesis was through the use of ornamental pattern*. The interlocking patterns of ornament were not superfluous decoration, but can be thought of instead as a kind of “glue” that allowed buildings and other designed objects to inter-lock and to form larger, more cohesive patterns. These patterns were both functional *and* expressive. (And actually, as we see with peacocks and butterflies, expression is in a real sense just another, deeper kind of function.)

Natural forms are co-generated together, interactively, as part of a mutually adapted evolutionary process known as “morphogenesis”. The result of this kind of process is that the parts at one scale form wholes at the next scale, and so on — creating larger and larger wholes that are not mere aggregations of parts. They are, as the saying goes, “greater than the sum of the parts”.

For some things in our world, “disconnected” design works reasonably well. The trouble is, such forms have no real capacity to inter-lock, and to connect into larger wholes, except in the most elementary mechanical way. (Think of Lego blocks that plug into one another, for example.) To achieve the inter-connected complexity of the natural world, we need geometries that have this necessary capacity to inter-lock and to connect, within a more evolutionary, mutually interactive system.

Good design within restrictive modernist geometries is possible, but very difficult. The examples we can point to are rare. Even among a relative few boutique showpieces, there exist scarce departures from visually dramatic but ultimately deadening form. The ideological constraint is far too excessive and burdensome, with the inevitable result that the vast majority of buildings created under this regime are unsustainable, non-resilient junk. The challenges we face do not allow patience for such a practice. We can, and we must, do better — and, we assert here, there *are* alternatives available.

There is a more serious reason to critique the continued use of architectural Modernism, and its “rococo” and “Neo-Modernist” variants, as suitable foundation for design in the 21st Century. That is because Modernism is not simply one style among many, but an expression of an elaborate discourse and practical methodology for the generation of environmental structure — and which makes a totalizing claim to its exclusive legitimacy. Modernism proposes itself as a universal form-generating discipline, allowing no alternatives. In turn, this methodology relies upon an equally elaborate theory of society, of technology, and of geometry.

What is surprising is how influential this way of thinking and working has become, given its

provenance among a remarkably small group of speculative theorists/writers almost a century ago. All the more alarming, this methodology's influence endures largely unquestioned, in spite of the intervening science and mathematics of nearly a century, and the mounting evidence of post-occupancy research.

So we arrive at a damning indictment, from the point of view of sustainability and resilience. Modernist pioneers' fundamentalist geometry destroyed architecture's capacity to form significantly cohesive wholes with one another, and thereby to create naturally efficient human habitat. Instead, we were left with a disordered collection of abstract art pieces — forced, in effect, to live in someone else's increasingly disorganized sculpture gallery.

This was no longer architecture, in the organic, natural (and human-evolved) sense of the term; buildings had become an environmentally maladapted form of gigantic sculpture. But this practice served as a marketable art-veneer for a toxic form of industrialized urbanism around the globe. It was particularly harmful because it destroyed the resilient low-carbon urbanism that had existed, and replaced it with resource-guzzling fragmentation, disorder, and sprawl. Now this fragmented urban pathology is reaching critical proportions around the globe, and is threatening to wreck the planet.

An expensive and wasteful game of changing fashions

There is an even deeper problem with the core logic of modernist design theory, which concerns itself with change and newness as a value in itself. As we have pointed out, this is inextricably tied to the evolution of Modernism as an industrial marketing strategy.

We can tolerate rapid cycles of fashion in our clothing and other consumer goods, perhaps. But in our built environment, we need new buildings to work together with the old, to maintain a coherent, durable, human-supportive environment. Ironically, it is not Modernism that has done that best, historically speaking, but traditional design types — notably, vernacular traditions using local materials and form languages suited to site and weather as well as the sympathetic blend of tradition with industrial technology created in the 1920s and Greco-Roman Classicism in its immense variety of adaptive forms all around the world. Yet all of those sustainable solutions were the targets for extermination by tenacious modernists.

The modernist approach to design is crude, since it depends upon a dangerous premise: the spontaneous re-invention of architecture by genius designers. Forget evolved solutions to climate, cultural needs, materials, human scale, and other inviolable constraints. Gone is the slow accumulation of adaptive responses, the patient evolutionary correction that produces resilient, complex designs. Modernism is all mental tinker-toy stuff, meant to function for a short while, and then be gone. Here we have transient and wildly expensive consumerism at its worst, played with buildings and pieces of city. It is meant to last as a set of Platonic ideas, but not as actual physical places. The products degrade, get dirty, show their age, and become hated.

By contrast, think of the long-lasting portions of London, Paris, or Rome, for example. There, two-millennia-old architecture has been repeatedly revived very successfully, and then endured over centuries: Romanesque, Renaissance, Georgian, Victorian, and Edwardian. These buildings, most already lasting usefully for over a century or more, are much loved and still used today — indeed, they comprise some of the most expensive and sought-after real estate in the

world.

But under the strange ideological radicalism of Modernism, we must never, ever, build such places again! Instead we are condemned (no, we are fortunate, said Loos and his contemporary devotees) to live in a world bereft of pattern, shorn of history and humanity, left only with cold industrial objects. We are promised that someone with sufficient skill (the genius architect) has somehow made them compositionally handsome, but that hope is not enough.

Methods of architectural design — especially those that revive or re-incorporate any motifs and geometric characteristics that might have been used before about 1920 — are regularly attacked as illegitimate, inauthentic, “pastiche”, or worse. Students who transgress are regularly flunked out; professors who dare embrace heterodoxy are regularly fired. National and international regulatory codes such as the Venice Charter, and the US Secretary of State’s Standards, are interpreted to *exclude* new contextual designs in historic districts, and to *require* contrasting modernist completions, as *the* exclusively “authentic” representatives of their present age.

The pervasive dominance of this regime today, and its outright suppression of other, competing approaches, is nothing less than extraordinary. Peter Blake relates in [*Form Follow Fiasco*](#) how manufacturers of industrial materials threatened to close down a prominent architecture magazine that dared to criticize one of their products, by collectively withdrawing their advertizing. In effect, corporate sponsors tightly control architectural information.

As a growing body of research literature documents, this state of affairs does exert a toll on human wellbeing. Loos was dismissive of the love that children have to ornament every available surface — perhaps a reflection of the stern parenting theories of his world, or even a reflection of Loos’ own childless life. But we now know that this hands-on experience of ornamentation forms an essential part of a child’s cognitive development.

The recovery of a shareable basis for life

In such a discussion, it is never quite enough to critique the failings of the mainstream approach, even if it is catastrophic. One has an obligation to provide a working alternative, which illustrates a proposed path to addressing the challenge. Once we stop favoring the machine aesthetic that produces giant abstract sculptures in place of buildings, then we can turn to nature, science, and common human values for new design tools. This is what those of us who are harshly critical of the current “business as usual” — like the authors — must also surely do.

So we work on new pattern language tools, new kinds of wikis, new strategies for making more walkable neighborhoods, and new types of buildings and places that learn from the successes of old ones. We believe that the problems we humans face today are largely of our own creation, and can be resolved by us too — IF we understand the structural nature of these challenges. But we also believe that it is long past time to surrender the dogmatic claim to a failing ideology of design — one that belongs to the last century and its failing industrial approach, and not to the next century and its biological lessons.

In creating a shared language for architecture and urbanism, one that relies upon positive human emotional and physiological responses, we find universals that cross all cultures, periods, and locations. This appeal to a shareable language was a centerpiece of Christopher Alexander’s

A Pattern Language, and is extended by Alexander's *The Nature of Order*, the present authors' own writings, and many others' work. A commons-based shareable form of architecture supports life in all its complexity, all of its emotional and even hidden dimensions, through the geometry and multiple configurations. The experimental evidence has been mounting that, because of its self-imposed geometrical limits, Modernism and its variants simply cannot achieve this positive response.

We have pointed to humans' innate biological need to create and enjoy ornament, as witnessed in all societies. Indeed, the cultural wealth of human civilization, in all its myriad expressions around the world, comes down to its ornament — its “illumination” of the most profound aspects of ordinary life. A healthy society must affirm and enable such an approach, and continue to develop tools to support it and make it feasible. This is as much an economic challenge as a social and environmental one.

Ironically, Loos was right, though in the opposite sense of what he intended: a crime had been committed, one that had inflicted “serious injury on people's health, on the budget and hence on cultural evolution”. To that we can add injury to the planet's ecosystems, and the life of cities around the globe. The crime was the adoption of a geometrical fallacy — geometrical fundamentalism — which is, quite simply, incompatible with a sustainable future.

APPENDIX: Nine Reasons Why Green Modernist Architecture is a Myth

We can now turn to debunk the recent claim by many practitioners, alluded to previously, that modernist architecture can actually be more sustainable.

True, many modernist “high tech” architects claim that their work represents the height of so-called “green building”. Gleaming new industrial icons of sustainability (enthusiastically and imperiously claimed to be so) are sprouting like mushrooms around the globe — in many cases replacing older traditional neighborhoods, or ecologically sensitive undeveloped areas. What is the actual evidence that they are more sustainable?

A new wave of post-occupancy evidence is demonstrating remarkably poor performance by many new sustainability icons — let alone several earlier generations of standard-issue modernist resource-guzzling buildings. The problems are not superficial, but go to the essential geometry of Modernism, and the rationally segregated “geometric fundamentalism” on which it is based. Problems include:

- ***Poor capacity to wear over time.*** The fundamentalist aesthetic relies on two eye-catching ingredients that are by definition perishable: newness, and pristine cleanliness. These qualities are striking (and appealing to many) when such structures are completely new. But as time passes, the accumulation of minor dents, streaking, and patinas, which would be acceptable or even complementary to more natural kinds of buildings — think of the beautiful patinas of Rome, say — become horrible forms of disfigurement in modernist buildings. The remedy (aside from accepting an increasingly ugly building) is either relatively constant and expensive maintenance and repair, or demolition — hardly sustainable.

- ***Inherent problems with curtain wall assemblies.*** Research shows remarkably poor performance for the glazed wall, fancy ribbon window, and exotic glass pattern assemblies that are hallmarks of the fundamentalist style. They might look dramatically transparent, but the high fashion comes at a steep price: typically profligate use of energy, and very likely, extravagant repair or replacement costs. It's possible to layer on complex sandwiches of special gas and reflective coatings to mitigate this or other problems — but these contraption-on-top-of-contraption approaches add significantly to complexity and cost, and increase the likelihood of early maintenance troubles. The simplest way to avoid the problems of such assemblies is not to use them in the first place.

- ***Other problems with maintenance, efficiency, and durability.*** The stories of new modernist architectural projects with serious construction problems and soaring cost overruns (in both construction and operation) are legion — many of which clearly stem from the irrational quest for novel, extravagant shapes that require untested construction methods. Modernist projects also typically require construction methods and materials with high-embodied energy and resources — steel, glass, concrete, and others.

- ***An indifference (or worse) to walkable streetscapes.*** Early modernists pretended to be untroubled by the oppressively blank walls and lack of human-scale details along the street, for the simple reason that they didn't care for streets at all. Le Corbusier, for example, was famous for his desire to “kill the street”, along with the “fungus” of sidewalk cafes and other essential human-scale elements of urban life.

- ***Poor ability to accommodate urban complexity and change.*** As Jane Jacobs famously pointed out in [*The Death and Life of Great American Cities*](#), Le Corbusier and other early modernists were obsessed with imposing a simplistic visual order onto a complex urban fabric — with disastrous results. The simplicity of this visual order was in its minimalism — again, a central tenet of modernist aesthetics. But forced simplicity forbids the geometrical complexity necessary for accommodating human life in the city.

- ***Reliance on visual and cognitive segregation.*** Architectural fundamentalists are fascinated by the merciless logic of crude, powerful early machines and industrial equipment — concrete grain elevators, steam ships, and the like. Their proposals for cities included similar machine-like segregations of simplified parts, from the largest to the smallest scales: zoned districts, super-blocks, buildings, walls, windows, columns, details — all stripped down to machine-like minimalism. But as Christopher Alexander warned in 1965, a city can't be segregated into such a neat hierarchy of parts, without damaging the life inside it. This is not how biological complexity operates, and it is not how human settlements operate.

- ***Evidence of cognitive problems from minimalist environments.*** Extensive research has documented the negative effects on children, the elderly, and other vulnerable populations of

environments that do not have a complement of rich experiential aesthetic variety. Some modernist environments may provide cognitively appealing and desirable qualities such as drama, contrast, novelty, and so on. But these by themselves appear to be inadequate and even possibly damaging characteristics, and it seems increasingly likely that we humans must also have a major complement of “biophilic” qualities missing from most Modernism. Research in environmental psychology suggests that what human physiology needs are fractal scales, patterning, spatial layering, interlocking geometries, and the like.

• ***Perishability of modern design fashions.*** Ironically, one of the key fundamentalist arguments is that the universality of Modernism would serve to avoid the vagaries of fashion, and thus be more durable. Of course history has shown quite the opposite, as the quest for novelty is by definition insatiable. So we have seen an endless cycle of briefly novel stylistic permutations: once-exciting new modernist buildings torn down only a few decades later, widely regarded by then as hated eyesores. Sometimes, incredibly, these same eyesores have been brought back yet again as exciting retro-futurist novelties — but with the same fate awaiting them once more, as the destructive cycles go on.

• ***Dependence on the car.*** Geometrically fundamentalist urbanism promulgated by CIAM (the *Congrès Internationaux d’Architecture Moderne*) became the blueprint of 20th Century urban development, built around fast superhighways and arterials, cutting off a series of segregated, unwalkable superblock structures. The human-scaled web of life, with its foundations of free pedestrian movement and common urban space, was erased by design.

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