

The “Law of Requisite Variety” and the Built Environment

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ABSTRACT

Simple yet powerful rules that govern complex systems shed light on human environments. Built environments that evolve freely over time develop a working complexity that is characteristic of both nature and traditional urban fabric. A city or portion of city without sufficient variety is a sign of either decay or totalitarian control. This can be judged by how responsive a governing entity is to the complexity of human needs. By forcefully imposing design monotony, post-war governments and building regulations deprive human habitats of the requisite complexity needed to create livable environments.

Keywords: complexity, cities, urban structure, urban variety, control, cybernetics

INTRODUCTION

Human physiology never evolved to handle empty or monotonous environments, because such environments are rare in nature and do not arise naturally. All such examples that surround us today are man-made. Even the most monotonous-looking natural environment reveals biological or physical complexity on some scale. When we first encounter empty environments, we become anxious, disengaged, and disoriented. Humans need to know where they are. Our ability to perceive our situation requires identifiable circumstances. This requires information. Information, in turn, comes from differentiation, the opposite of monotony. We react with alarm to informational monotony (information deficit) and prefer to be—and will linger in—a place whose organized complexity provides it with a unique identity.

Furthermore, variety is a necessary characteristic of complex adaptive systems (Salingaros, 2015). How complex systems form and operate precludes monotony. Since monotony in nature is unexpected except under extreme climatic conditions, seeing it in the built environment implies that it must have been imposed. Whereas systems of complexity are inherently efficient, systemic monotony requires an artificial process whose operation and maintenance diverts energy from underlying systems. This wasteful use of resources props up a goal that has no useful function; it merely caters to a peculiar aesthetic preference.

ASHBY’S LAW OF REQUISITE VARIETY

A monotonous or minimal system is, however, easier to control. To help us see the relationship between controlled and controlling systems in the built environment, let us compare the interaction of two complex systems: how they can relate to each other, how one can control the other, and how one can destroy the other. The “Law of Requisite Variety,” developed by W. Ross Ashby (1956) in the field of cybernetics and complex systems, may be stated as follows: “any system that governs another, larger complex system must have a degree of complexity comparable to the system it is governing.”

The degrees of complexity in a physical system and in that of a system that governs it must be comparable.

It turns out that you cannot use simplistic controls to effectively assemble and direct a working complex system. Ashby used as his example the ability of our immune system to formulate a wide variety of responses to infection. The mechanism for recognizing pathogens and directing the production of antibodies has to be at least as sophisticated, and as capable of variation, as the invading pathogens themselves. Simplistic controls can only be usefully employed to operate an equally simple system.

HOW THE BUILT ENVIRONMENT CONTROLS OUR LIVES

Physical settings control our lives, and thus one system (the buildings) controls the other (the people), and vice versa. People must live in the geometry they build, and that affects their lives for better or for worse. Society adjusts to the morphology—the physical structure—of its buildings and cities just as surely as it does to its civil laws and its social, moral, and other codes and standards. Yet, we have a history where the cultural mainstream denies this important system of adaptive complexity whose duality governs all of humanity.

The following rules outline the mutuality of our adaptive living systems, and underline how a society’s complexity is balanced with that of the city.

<p><i>Table 1: Systemic duality of city and society.</i></p> <ol style="list-style-type: none"> 1. The users control the built environment by constructing it in the first place, and by modifying it continually to suit a complex and dynamic set of needs. 2. The geometry of the built environment contains and controls the activities of its users through physical spaces and their psychological impact. 3. In a balanced society, these two systems—users and physical settings—mutually interact in an equitable two-way relationship. 4. While the built environments of each of the world’s living cultures can differ dramatically, they all have a comparably high degree of variety.
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5. Individuals have an inalienable biological right to control their immediate living environment, by modifying and ornamenting their dwellings and workspaces.
6. A built environment without variety indicates that a society has neglected its most important systems of organized complexity.
7. Environmental monotony is a sign of totalitarian control, either direct through state imposition, or indirect through a powerful market system.

of Requisite Variety,” the built environment—one of the principal governing systems of our society—must necessarily embody the same degree of variety, and the same general type of variety, as the society that it governs.

WHY INDUSTRIAL SIMPLIFICATION IS DEHUMANIZING

The built environment was drastically simplified as European nations began applying a crude industrial model to reconstruct bombed-out cities following World War II. This may have been economically expedient in the short term, but the philosophical drive for simplification—and hence monotonous repetition—came from upheavals in society at the beginning of the 20th century: World War I, followed by the rise of Communism and Nazism. Those forces are not scientific, even though they were born from the rise of science and massive industrialization. Political and social movements converged into a new cultural mainstream, which sought to forcibly re-form humanity so as to disconnect it from a past that was judged deficient, a failure. In the later decades of the century, the rest of the world simply followed the fads of the West.

To illustrate these points, we need to describe two general systems. The system of buildings, streets, districts, and cities that define the built environment constitutes a geometrical framework that can have varying degrees of complexity. That physical system links to and governs a separate system composed of human life and behavior. This human system (looked at separately from the built fabric) comprises many linked levels, scaling from the level of one person up to the level of the whole society. The interactions among human beings add further layers of complexity to the complexities of each person, and those top layers generate our society and its culture.

Each traditional and vernacular settlement contains embedded in its morphology the organized complexity of its citizens and the extra levels of complexity of the society that they built. The morphology reflects a more equitable balance between the two systems: (i) built fabric and (ii) human society. Throughout history, a strict reciprocal relationship has been in place: people and society govern their built environment, whereas the built environment in turn governs people and society. “We shape our buildings; thereafter, they shape us,” said Winston Churchill. The complexities of everyday life—the tasks of daily survival—reflect the structural variety found in traditional architecture and urbanism.

Profound differences in social structures and practices are directly reflected in and by the morphological differences among the traditional architecture and urban fabric of distinct societies. What is similar, however, is their high degree of organized complexity (Salingaros, 2005). The similarity is uncanny; one might almost say supernatural. According to the “Law

Prejudices of the time, manifested as intolerance of traditional design, were presented then as scientific truths (Salingaros, 2005). Those ideas were accepted without thorough analysis as part of the vanguard for a sweeping revolutionary social agenda. The most visible common face of such utopian dreams is monotony in designing the built environment. Since traditional environments are morphologically complex and hence naturally adaptive, theorists just assumed that the new anti-traditional environments required a simplistic visual approach, which tended toward the non-adaptive. Modernity entered the cultural mainstream as images of sleek and shiny machines from the 1920s, which acquired the status of religious cult symbols. Aside from being unscientific, this approach was responsible for psychological malaise caused by an overdose of environmental monotony.

Those trends masked an even darker side. Social engineering considers human beings as objects without variety, to be easily and collectively molded into anything the state desires. The complexity of society as it emerges from interactions among people

naturally resists this simplifying worldview. Humans typically dislike being cogs in a machine, and will fight it. They must therefore be forced to lead ordered lives governed by an ordered geometric setting. This inhumane objective triggers cognitive dissonance: cultural norms demand a monotonous mechanical world, whereas human biology craves variety and ordered complexity. The same people who support the program of homogenization also react negatively to it. This is never stated explicitly; instead, we get wonderful promises of a brighter and more just future, more streamlined and healthier living conditions, decent affordable shelter for the masses, et cetera. Advocates of this worldview used building types originally intended to house industrial production to house people instead, while presenting themselves as driven exclusively by progressive social concerns.

Ashby's "Law of Requisite Variety" still holds, however, and reveals a sobering, even frightening truth: a repetitive, monotonous, overly simplistic built environment drastically simplifies human society, undermining its natural adaptivity. The deadening influence of design monotony limits options up and down the social chain. Applying a machine aesthetic to re-shape the world merely gives it the outward appearance of efficiency without the benefit of genuine efficiency, which atrophies without the adaptivity of ordered complexity. The superficial appearance of a simplistic order is mistaken for industrial efficiency. This has become the preferred typology for new cities the world over. That typology is supported by municipal codes and reinforced by professional institutions, effectively outlawing an architecture of adaptive complexity, of variety, in the planning and design of cities. Society in places so ruled is forcibly simplified, and as a consequence, becomes easier to control.

CONTROL, INTOLERANCE, AND FORCED MONOTONY

The freedom represented by variety seen in the built environment is an antidote to the dystopian objective of homogenization. Variety is messy, but also liberating, and undoes the logic of top-down control. What was until recently misinterpreted as disorder in the development of modern self-built settlements, such as slum-like favelas that encircle many African, Asian, and Latin American cities, is now studied

to uncover practical strategies for how a healthy city can stay alive through adaptation and variety (Salingaros, 2011b). Yet many governments still seek to force their citizenry into an "efficient" industrial society composed of simplistic, repeating, non-interacting units. The cultural mainstream has adopted scientific notions of mechanical efficiency that do not apply to complex systems, and least of all to the highly complex systems that represent human society, on the one hand, and cities, on the other. Ashby's law reveals that a simplistic, top-down system can never control the variety of a self-generated informal urban fabric: it can only destroy it. States desperate to govern such regions that develop beyond state control frequently bulldoze what they call slums, only to replace them with monotonous blocks of industrialized housing. The variety of organic urban fabric is an affront to the industrial aesthetic. The massive replacement of older and informal building stock becomes an obsession. Distinguished academics and those who run the government planning offices advise legislators to implement a crude industrial model for cities.

A century ago, Art Nouveau, Art Deco, and other architectural languages rich in ornamentation used complex prefabricated architectural units without surrendering their creative authenticity. After that time, a cultural condemnation such as the 1920s slogan—"pure design for a new society" blocked variety in design, which survived and prospered only in those sectors of society outside the direct control of centralized power. The ubiquitous design plainness that insists on monotony in our time is driven exclusively not by practicality, but by a culture that dominates most of the institutions that guide development of the built environment. Eliminating visual ornamental variety might seem a harmless matter of personal preference, until one realizes that it is merely one piece of cultural engineering shaping all scales of the city.

Design monotony imposed on the built environment erodes the complex system that encompasses the lives of individuals who make up that society. Paradoxically, the cultural mainstream from all around the world still embraces monotonous design as a sign of progress. Even after all the failed examples, devastating social damage and countless ruined lives, the dominant culture continues to promote monotonous architectural and urban typologies. Slabs of concrete and steel, stripped of the human touch

and, in the latest wrinkle of fake scientific ideology, literally twisted by computer, are still being touted as “liberating new ideals.”

Design monotony is also allied to deliberate cultural destruction. A dominant cultural norm authorizes regimes to obliterate surviving architectural variety from previous generations, including churches, mosques, synagogues, and temples, replacing them with monotonous industrialized buildings. This occurred in Europe under the Nazi occupation, Cambodia under Pol Pot, China during the Cultural Revolution, and much of Russia and Central Europe under Soviet authority. In a related vein, certain fundamentalist religious regimes exhibit similar intolerance toward architectural and artistic treasures. ISIS is only the latest example. They consider the past a menace that must be effaced, because complex organic forms undercut blind obedience to abstract ideals. Guaranteed tourism revenues are not enough to counteract the fanatical desire to destroy variety as embodied in a country’s heritage.

Society’s worldview has shifted, however, so that recognizable variety no longer is seen as an automatic threat to the rigor of industrial production. Monotony is no longer considered necessary to industry. Industrial objects can be produced with great variety. Complex machines such as aircraft, computers, scientific instruments, and children’s games are mass-produced. Increased variety in many fields of design suggests a growing industrial freedom, the basis for built resilience in the economy.

CONCLUSION

The revolution in urban design re-introduces mixed use, emphasizes the human scale, protects the pedestrian realm, and carves out small usable urban spaces. As long as these elements come from variety, and not formalistic top-down design, they catalyze complexity and life in the social environment. These same forces have created livable places for millennia, but now forceful criteria are needed to re-establish variety after it was destroyed through a misapplication of science. A market-driven strategy of urban complexity offers hope for undoing the design monotony implemented by the post-war cultural mainstream.

One method is to return to local planning with traditional models. Those typically evolved over generations of adaptive building, delicately balancing human-scale activities and uses against natural forces. Solutions were achieved by trial-and-error, whereas design mistakes could not survive for very long. For this reason, traditional patterns embody energy savings and resilience achieved within a local economy and available materials. In many places over the world, traditional urban design is being revived to create human-scale urban fabric, using a historical cultural understanding augmented by today’s technology.

Another method is to allow free development of a new interactive urbanism in today’s megacities. People’s practical ingenuity, guided by an innate biological sense of connectivity and organized complexity, generates living urban fabric. This phenomenon is occurring throughout the world. It is in humankind’s best interest to support and guide such growth and not to impose top-down control through outdated industrial images. Nor should the built environment be sacrificed to twisted and useless trophies of a new global elite. Although those “futuristic” buildings look superficially complex, they are only more examples of uncompromising industrial control.

In certain situations, user participation can be usefully implemented within a commons approach (Salingaros, 2011b). This is the collaborative implementation of design, in which agreement among the users decide key aspects of a project. It could also include a collaborative effort at the stage of construction, but what is interesting concerns the shared conception of design and planning. Relying on people’s collective intuition and common architectural memory (again, relying on inherited culture) makes it easier to come up with a human environment. Often, the power of direct local cooperation is the only force capable of standing up to the inhuman top-down architectural interventions promoted by a global elite and imposed by shortsighted politicians.

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