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Reductionism Undermines Both Science and Culture

by **Ramray Bhat and Nikos Salingaros** (March 2013)

Introduction

Reductionistic thinking, which is the philosophy of contracting complex systems in science and society to smaller or single causalities, is dangerous. With this contraction comes an indifference towards uncovering and appreciating complex explanations and the variability contributed by the context. In the sciences, reductionism leads to the unfortunate skewing of effort and funding towards what are promoted as “basic” questions, and the neglect of disciplines that are most likely to help humanity by acting on practical scales. The effects of reductionism in society are even more alarming. Reductionistic thinking leaves little room for variety, cultural traditions, living urban environments, or religion, thus reducing our worldview to a sterile minimalism bereft of several of the most glorious achievements of evolved human civilization.

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There is also the additional and more practical consequence:
reductionism is responsible for leading us towards societal collapse.

Notwithstanding the continued imagery of the wild-haired scientist untouched by surrounding happenings and upheavals, science has intensely contributed to, and at times rewritten, social and political histories. Among the more contentious of its contributions is the philosophy of reductionism. Thus physicists in the earlier part of the last century were prone to investigating the dynamics of atoms and everything smaller than them, as if matter and all its wonderful properties could be explained only through protons and neutrons, later moving on to quarks and other such elusive elementary constituents. Similarly, much of biology in the latter half of the twentieth century was devoted to understanding and developing the tools for understanding the workings of genes, to the extent that Richard Dawkins advocated a worldview wherein it is the genes that live and evolve, using individuals and their anatomies as vehicles for perpetuation (Dawkins, 1990).

Advances in both material physics and biology have exploded these myths and shown that explanations of how inanimate and animate things work, and are made, cannot simply be broken down into their components. The very idea of any component being elementary has lost its nineteenth-century meaning, where the whole could be put together straightforwardly from elementary mechanical parts. Mechanisms are in fact intricate and layered, and interactions between components contribute as much, if not more, as the components themselves. Moreover, the environmental context also matters and is an intrinsic part of structure and function. Nevertheless, the reductive mindset refuses to go away. What's more, like all the different ways by which science and technology have come to dominate our lives, the reductionist worldview now influences how we think about anything and everything.

The pathologies of urban dystopia

One area where reductionism's devastating consequences are most acutely felt is urban planning. A city is a complex multilayered system,

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teeming with components, very much like a biological organism.

Following the Second World War, architects and planners instituted a top-down approach to planning and constructing the city that reduced it to simplistic components (Salingaros, 2000). Complex urban systems were contracted and dismembered by separating distinct multiscale functions: residential, commercial, workplace, pedestrian transport, vehicular transport, green areas and parks, and manufacturing, as a result of the industrial mobilization for World-War II. All of these had earlier evolved together like the distinct and complementary functions inside an organism. Pre-war cities combined all their essential urban functions spatially in an "urban web" (Salingaros, 2005: Chapter 1). After the war, residences were separated from commercial areas and workplaces, pedestrian regions were separated from streets, and so on. This is called "monofunctional zoning", an approach to planning widely held responsible for extinguishing vibrant urban life in our post-war cities.

The reductionist approach to urbanism decomposed all the complex components of a living city and discarded many vital ones as "inessential." All of this was done with the approval and encouragement of "experts" who studied city functions scientifically but reached totally erroneous conclusions, while the most enlightened criticism comes from the doctor/writer Theodore Dalrymple (2009) and the philosopher Roger Scruton (2008). The pathologies of functional separation, and the concomitant emphasis on the largest scale (where highways take preference over medium-capacity and narrow streets, sidewalks, and footpaths; skyscrapers take preference over walkable four-storey compact buildings; giant centrally-planned parks take preference over older networks of small neighborhood parks) are endemic in our industrial society's preoccupation with some imagined "efficiency of scale." This is nothing other than a pernicious manifestation of the reductionistic fallacy.

The architect and software pioneer Christopher Alexander pointed out this fallacy in understanding urban form in his classic paper "A City is Not a Tree" (Alexander, 1965). More recently, Alexander has presented

an analysis of structural complexity that emphasizes cooperating hierarchical levels, and which gives proper importance to a system's emergent properties. His latest work is not specific to architecture and city planning, and is eminently applicable to all complex systems (Alexander, 2001-2005). This work is not well known among researchers in science, economics, or the humanities. We believe that it is extremely useful because it offers an antidote to the reductionistic approach being forced onto biology and many other disciplines.

It is unfortunate that urbanists working in government planning departments re-wrote city planning regulations following the Second World War into a highly reductionistic set of rules. Governments were motivated by a misplaced belief that crude industrialization together with reductionism and collectivization had the power to solve all of humankind's problems. Those zoning rules apply today; so that it is illegal to plan a human-scale city with mixed uses and the dynamic cross-fertilization we find in traditional cities the world over. Instead, we see applied gigantism coupled to an abject neglect of human scale, losing in effect those myriads of small-scale activities and physical spaces and structures that create and enrich human life in urban settings.

People interact with buildings, other people, built and natural forms, spaces, surfaces, urban vegetation, and ornamentation, and those interactions occur on a multitude of spatial and temporal scales. In great urban spots, persons feel more alive because they are nourished by the geometry of the environment. This sensory feeling of "life" is shared by other people experiencing the same space, hence a "living" environment leads to common bonding among those individuals who happen to share that space for a few seconds, an hour, a day, or a lifetime. But post-war urbanism denies this visceral experience, and instead imposes someone's dead vision of an abstract impersonal world that is supposed to work mechanically (Salingaros, 2012). The New Urbanism movement in the United States aims to reverse this catastrophic trend, but it is fighting against a mechanical/industrial vision of the built environment that appeals to governments and powerful commercial interests.

So far we have criticized the effects of reductionism in urban spatial dimensions. Equally catastrophic was the postwar neglect of a city's temporal complexity. The traditional network city defines a multiscale web of urban events and flows, but its vital complexity in the time dimension ceased to be visible to those responsible for maintaining its workings. Planners instead became obsessed with building gigantic static grids as a setting for buildings as urban sculptures. None of this had anything to do with people's movements, interactions, or the accommodation of life's dynamic processes. Concepts such as fractal loading (Salingaros, 2005: Chapter 7) that drove human urbanization in the first place were ignored and their importance denied, because they conflicted with a reductionistic image of a city as created from a gigantic version of children's building blocks.

As humanity faces an ecological disaster because of uncontrolled reliance on a finite source of fossil fuels, our decision makers still ignore the obvious solutions that evolved over millennia: an organic city fabric that mixes distributed uses, scales, and flows. A dynamic "scale-free" city that works better over all spatial and temporal scales, and that emphasizes none above others, is much more resilient to the inevitable energy crash. Our traditional cities, rejected by twentieth-century planners because they are "messy" in the same ways that biological organisms are internally "messy," provide the non-reductionistic solution to maintaining the quality of human life on earth. The solution to housing the world's population is to channel the organic forces behind the generation of self-built settlements, and not to insist upon imposing the reductionistic solution of the same high-rises everywhere (Salingaros, 2005).

Tradition, religious belief, and sustainability are casualties of reductionism

Urban structure is not the only practice that has been compromised by reductionistic thinking. Going outside concrete and obviously practical matters altogether, we run into the old gap between science and religion. Many people influenced by reductionism are unwilling to accept

a worldview where, along with science, concepts such as religion are quintessential contributors to culture and its evolution. Not surprisingly, this attitude creates resentment from the world's population that happens to be religious. The present essay is not the place to resolve this issue; nevertheless, it is interesting that the problem we are addressing also has implications for human society and culture in a very deep sense. Reductionism runs antagonistic to historicism, the philosophy that advocates analysis of any object or construct by emphasizing its historical, geographical, and cultural setting. Reductionistic thinking biases policies determining the interrelationships of nations and peoples, towards industrially successful archetypes that remain indifferent to the observation that different communities, ethnicities, and civilizations have evolved their own tenets of justice, social interaction, and aesthetics.

Within this observed range of plurality there exists a basic commonality that respects evolved complexity, the existence and communication with different states of meaning and consciousness, and the individual creative potential of human beings. More than just leveling distinctions among cultures, therefore, reductionistic thinking erases their underling complexity and reduces people to a one-dimensional definition. And this contracted dimension is strictly a crudely mechanical one. Any additional states such as those responsible for the existence of mind and meaning, of connectivity to the multiscale phenomena in the universe and to religious dimensions, are denied.

We wish to draw attention to the fact that much of traditional art (visual art, architecture, music, dance, and literature) has been, and in non-western societies, continues to be inspired and motivated by religion. The authors as scientists (and not speaking as defenders of any particular religious point of view) acknowledge that this creativity exemplifies one of the zeniths of human achievement, through a process that has evolved for millennia since the beginnings of the human race. Furthermore, the complexity of social interactions combined with traditional heritage gives meaning and hope to the life of billions of the world's population. All of that supposedly has no place in a reductionistic

worldview that denies meaning inside a social context, and any form of higher meaning in general. Dawkins once again applied his reductionistic thinking to argue against religion (Dawkins, 2006), proposing a human existence with a vastly restricted scope. But reductionism in society severs us from a complex and nourishing tradition, the better to re-attach us to a one-dimensional framework manipulated by others.

Towards a synthetic worldview

An increasingly adopted viewpoint in science looks at matter and its influencing properties as affecting each other's structure and function in a dynamic and reciprocal fashion; i.e., causality flows both ways. At least one of the founders of sociology, Émile Durkheim, came close to proposing a bidirectional relationship between social dynamics and religion (which was overlooked when others used his ideas for reductionistic political ends) (Durkheim, 1915). Thinking through analogy, does society create art, or does art generated by inspired individuals shape and thus create society? Here too we would argue for a bi-directional causality. Moreover, the absurdly one-dimensional art prevalent in the West over the past few decades has had devastating consequences on the complexity of a healthy society that is reduced thereby. "Health" in any system, as measured by the continued balanced working of all of its parts, cannot be maintained without a requisite complexity, as was already pointed out by Ross Ashby (Ashby, 2011).

A resilient approach to the environment, and in figuring out how to prevent human beings from destroying it, requires abandoning polarizing twentieth-century political divisions. As Roger Scruton convincingly argues (Scruton, 2012), the solution lies in local (i.e. small-scale, topical) responsibility, and away from the top-centered collectivist state, monolithic bureaucracies, or global multinational control. At the same time, society needs to stop its willful and ideologically-driven desecration of evolved traditions, because those are in many cases still the best sustainable alternatives to non-resilient twentieth-century practices. Using science to promote progress is wonderful, but it must be in an enlightened rather than reductionistic framework, otherwise the

consequences could be devastating in the long term.

There is much more here that is eminently practical, for the complexity of cultural practices evolved side-by-side with our understanding of nature. Locked within cultural histories we discover sustainable practices that helped to preserve the natural environment during millennia of human habitation and use. One such example is small-scale agriculture contingent upon maintaining seed variety (Altieri, 2009; Shiva, 1988). Reductionistic thinking under the slogan "economy of scale" rejects contextual and geographical diversity and eliminates such ancient but proven practices, replacing them with an industrial agriculture dependent upon imported, non-reproducing seeds. This drastic change benefits the largest scale in a command hierarchy (i.e. the multinational corporation that produces such seeds through genetic modification, together with politicians who uncritically support the eradication of their country's local agricultural practices) and destroys the smaller scales of the agricultural system. Its devastating consequences on society in developing countries are too well known to elaborate here (but see Bello and Baviera, 2009).

The above example is a case where a complex system: in this instance, traditional sustainable small-scale agriculture intertwining hundreds of millions of people and their culture, way of life, social meaning, and religion is contracted to a tiny elite social group (directors of a global multinational; a few politicians temporarily in power). It represents a command move hierarchically upwards, in which social complexity and environmental resilience is sacrificed to benefit one single level in the political/economic system. The hoped-for "economy of scale" is an exclusive goal of this one scale of a vast socio-cultural system, and the very process neglects all the other scales, their interdependence, and the principle that the wellbeing of the population depends upon maintaining the web of scales making up the complex system.

For those not educated in the sciences, it is very easy to be misled into believing that all of science is reductionistic. Since that would contradict what people intuitively perceive as true about the nature of the universe, the value of science itself is thereby diminished. When

moreover reductionistic scientific arguments are misused to erase and negate millennial traditions, folk art, innate human creativity, human-scale architecture, material culture, informal urbanism, and sustainable ways of life, people react by being driven away from science towards irrational beliefs and superstition. At least those promise hope in contrast to the onslaught of “rational” reductionistic methods that erase crucial and timeless aspects of humanity. Which opens up societies to the opposite danger of reductionistic belief systems.

Reductionistic politico-religious movements promote the loss of healthy spiritual variety while feeding and exploiting our basest instincts.

Invariably, they represent some group’s struggle for power couched in an absolutist philosophical or religious cocoon that makes the movement attractive to new followers. Reductionistic thinking has achieved the remarkable goal of repeatedly de-humanizing human beings by suppressing their complex potentials and inborn ability to distinguish ugliness from beauty, moral right from wrong, and creation from destruction. Even established religions go through an occasional period of contraction into reductionism, during which embarrassing and terrible things happen: such as the willful destruction of their own artistic and cultural heritage in an iconoclastic rage; the persecution of people holding different beliefs; or the mistreatment of fellow believers for imagined apostasies.

Starting in the early twentieth-century, sustainable practices and cultural traditions were replaced with a sleek and flashy mechanical utopia. The mass media convinced people that industrial products were preferable to living structures. And that economic and social progress demanded that the former replace the latter. This monumental deception expressed a reductionistic worldview. When the bubble of “progress through industrial production/consumption” bursts, the only solution will be to laboriously re-build the resilient multiscale complexity of our artistic, cultural, belief, and ecological systems. But, whereas reductionistic collapse is very easy to accomplish, it is extremely difficult to reconstruct complexity so that it works. That is a task akin to generating a living organism, which is a secret we are not privy to. The world has

ignored and even intentionally destroyed the complexity of the natural systems upon which life depends. And the vast loss of biodiversity that this reductionistic consumer madness achieved is irreversible.

We do not entirely agree with Joseph Tainter, who attributes societal collapse to increasing complexity and the associated rising energy use due to that complexity (Alexander, 2012; Tainter, 1988). We instead prefer to interpret the historical data as a change in systemic structure that re-arranges the complexity to make the system less resilient. Societal complexity turns out to be stable and healthy for as long as it is distributed in a multiscale interactive manner. It is only when a complex system is skewed towards one dominant scale or purpose (e.g. a unidirectional power level; an energy-wasteful and usually large-scale abstract goal; mobilization for war) that it suppresses the other levels and could become pathological. Without getting into the debate over voluntary simplification of today's society in order to prevent ecological collapse, we encourage researchers to study the system structure, and in particular the blatant instances of reductionistic practices that are indeed wasting available resources.

Conclusions

This essay touched upon many seemingly disparate topics, from the sciences, to cities, and from culture and aesthetics to religion. We suggested a unifying thread for understanding all of those phenomena as emergent manifestations of their multilayered causalities. Emergence is not a "neovitalist" notion but simply stands for properties that are products of hitherto undiscovered scales or hidden interactions between established ones. Emergent properties are what differentiate the 'real' from what Scruton calls the 'fake' or kitsch (Scruton, 2012), which are mere facades and fabrications of what is obvious and visible in real constructs. For this reason, one has to respect the overall complexity of something that has evolved over time, be it a work of art, a city, or a traditional society, and accept certain of its features that we cannot comprehend at the moment, given the limitation of the tools and methods available to us. The arrogance of some reductionistic thinkers

that leads them to dismiss everything they cannot explain using a mechanistic approach is not only wrong, but also dangerous. Hopefully, a more enlightened mindset, one that takes a positive historicist and interdisciplinary approach, can now help to validate complexity wherever it is found. We can study complex systems for the lessons they provide us, and not damage them as a previous generation of “experts” did by applying reductionistic thinking.

In conclusion, our discussion is not just about aesthetics, but touches upon the very survival of humanity and the ecosystems that support life on earth. We feel sufficiently alarmed by the present approach, which rests upon exclusively reductionistic advice given by experts to both governments and the private sector. We are not optimistic that modern societies can avoid catastrophic systemic collapse by continuing to trust those same experts, all of whom are firmly rooted in a reductionistic, mechanical view of the universe. Major decisions that affect the future of humanity and civilization: what types of science to fund, the shape of our buildings and cities, providing a fertile educational and media environment that nourishes a symbiosis between tradition and the culture of life, require a new kind of input. Realizing the near-impossibility of diverting a comfortable way of doing things that has so far produced great material wealth, it is nevertheless imperative to turn to anti-reductionistic thinking so as to recover sustainable aspects of humanity lost in the past century.

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