1-2015

New Songdo City: A Case Study in Complexity Thinking and Ubiquitous Urban Design

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NEW SONGDO CITY: A CASE STUDY IN COMPLEXITY THINKING AND UBIQUITOUS URBAN DESIGN

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ABSTRACT

A new urban form has emerged amid the perfect storm of global crises: climate change, energy transition, demographic shifts (growth, aging, and urbanization), food and water insecurity, pandemics, economic stress, and ecological degradation. Known as "smart cities" or "ubiquitous cities," this urban form is characterized by deployments of computer technologies and analytics that promise enhanced efficiencies within the urban metabolism. This paper presents South Korea's New Songdo City as a case study in ubiquitous urban design by asking if it constitutes an opportunity within the perfect storm for an emergent, resilient urbanism. A key player in building New Songdo City is Cisco Systems. The project is an important strategic transition for Cisco Systems as its move from internet "plumbing" (routers) to whole systems design. An emergent property within global capitalism, ubiquitous urban design is a driving force in reproducing markets, technology, and investment. The emergent property, however, is nested within Gale International's (the developer) top-down, Haussmann-like approach to urban planning. It has a high modernist, linear approach to urban design that attempts to impose order on the oscillating environment of global crises. Core to the resulting tension between bottom-up and top-down approaches, is how ubiquitous design increases efficiency within modernity's late conservation phase, and how it drives the system into a deeper state of overshoot that threatens to tip into a hard collapse. As we build more of these cities, we need to question if they are the proper strategy for weathering the perfect storm

Introduction: The Bridge to the Future

Among the great lines of social science inquiry is the process of becoming that rests at the core of humanity's reproduction. Every moment we experience the predictable yet unstable flow of regeneration, a process of local to global micro and macro systems interacting to constitute anew the world we live in. Within the flow resides the potential for emergence where random interactions within the sub-parts of a complex system find repetition that result in the formation previously unknown patterns. With further repetition emerging patterns form rule-sets that constitute the production of new systems. Commentators like Steven Johnson (2001) and Malcolm Gladwell (2002) teach us that emergent properties are hard to discern, and often do not become knowable to us until after the fact of their formation. Given the complexity of a globalized world, one experiencing unprecedented stresses and turbulence within its key systems, we face the challenge of knowing when something new and important is transitioning from the world of noise (the random un-patterned interaction of system parts) to the process of becoming, what complexity theorist Mark Taylor (2001) describes as the process of "in"- "formation." The time scale of the process of becoming is part of the discernment challenge. In some cases, the tipping point is sudden and brings radical change, while in others a Braudelian wave of long duration best defines the process of becoming. Of course, part of the line of inquiry concerns the question of if rapidly emergent properties are actually the product of the long duration, as suggested by E. P. Thompson's (1965) notion of the "Great Arch," in which bourgeois sentimentality came into being through multiple, mini-revolutions spanning a century.

Walking along almost vacant streets designed for large, urban automobile traffic, one comes to the edge of New Songdo City, an "instant city" that the City of Incheon, in the Republic of South Korea, built from scratch. A six-story tall building with a silver apron of mixed glass and metal stands on the edge of the urban form facing both the newly constructed urban form and an expanse of land, reclaimed from the sea by the mega-development project. The structure's design consists of oddly juxtaposed straight lines with long curves and seemingly random stairways, patios, and entrances that make one wonder if the building best resembles Picasso's Cubism rather than an example of the "smart city" planning of the city's developer, a Boston, but now New York City, based firm, Gale International. Entering "Tomorrow City," as the developers, in an embarrassingly over-eager attempt to brand their creation as a "bridge to the future" (Kuecker 2013), have named the building, one finds a fascinating collage of built spaces designed to showcase the cutting edge gadgets of 21st century technology, the so-called "internet of things" that some see as representing an emergent property that will generate a new complex adaptive system both utopian for the human condition and savior to a looming planetary collapse. Tomorrow City occupies 47,000 square meters (505,900 square feet), that contain the U-Transit Center, U-City Vision Center, U-Mall, and U-Square; all spaces of demonstration, for the smart city's ubiquitous urban design.

Figure 1: New Songdo City's "Tomorrow City"

After visiting Tomorrow City, one might understand why so many observers resort to superlatives in their attempts at capturing what New Songdo City represents. Halpern, LeCavalier, Calvillo, Pietsch, in their essay, "Test-Bed Urbanism," pronounce, boldly, "Songdo is, arguably, the most extreme instantiation of a far more prevalent and genuinely ubiquitous faith in the place of big data and interactive feedback to monitor and sustain daily life" (290). In the *Foreign Policy* special 2010 issue, "Metropolis Now," Parag Khanna (2010, 128), a Senior Fellow at the New America Foundation, wrote, "Songdo might well be the most prominent signal that we can—and perhaps must—alter the design of life." Greg Lindsay (2010), a business journalist and promoter of John Kasarda's areotropolis

urban design (Kasarda and Lindsay 2011), boldly states, "New Songdo is the most ambitious instant city since Brasília 50 years ago." Interviewing author J.C. Hallman, *Salon* on-line magazine explained (Rogers 2010), "New Songdo is the most ambitious of the six examples in J.C. Hallman's 'In Utopia,' his new book about modern-day utopian projects. Fascinated by the decline in utopian thinking over the past century, and inspired by his own suburban upbringing, Hallman wanted to look at far-fetched ideas that are pushing the boundaries of our social imagination — and, to varying extents, succeeding."

A new urban form has emerged amid the perfect storm of global crises: climate change, energy transition, demographic shifts (growth, aging, and urbanization), food and water insecurity, pandemics, economic stress, and ecological degradation (Kuecker 2007). Known as "smart cities," or "ubiquitous cities," this urban form is characterized by computer technologies that promise enhanced efficiencies within the urban metabolism. This paper presents New Songdo City as a case study in ubiquitous design by asking if it constitutes an opportunity within the perfect storm for an emergent, resilient urbanism. The essay utilizes complexity thinking to explore smart cities as emergent properties, which is the central organizing concept for the essay. To better understand the relationship between the smart city, emergence, and maladaptation, the essay also integrates critical theory with complexity thinking, which contributes to the growing critical urbanism literature on the topic of smart cities. The essay commences with a discussion of smart cities and their relationship with capitalist reproduction. Building from this analysis, the essay next considers New Sondgo City within complexity thinking, and develops the emergent properties analysis of smart cities. The following section considers the "true believer's" epistemic, which is

juxtaposed to a discussion of smart cities and the "right to the city" in the final section. Together these sections argue that smart cities represent a maladaptation to the perfect storm, a form of emergence that will sustain a death spiral of systemic overshoot. Additionally, the essay argues that the pursuit of smart city prevents alternative forms of emergence that enhance human resilience in an era of deep crises.

Internet of Things, Smart Cities, and the Reproduction of Capital

Smart cities find their origins in the emergence of the "internet of things" made possible by the continued waves of information technology revolutions of the past 30 years. In particular, the explosive development of "smart phone" technology and its global adaptation, made it possible for the vast array of electronic appliances and gadgets connected to the world wide web to be controlled by one device. International Data Corporation (IDC) (Clarke 2013, 4) estimates that about 1% of connectable devices are currently connected to the internet. By 2020 the number of connectable items will reach a staggering 212 billion "things." Further, they estimate that by 2017 earth will have 3.5 billion people connected to the internet, and 64% will be by mobile connections. "People and connected things will generate massive amounts of data, an estimated 40 trillion gigabytes, that will have a significant impact on daily life," explains the IDC study (Clarke 2013, 4). "The internet of things will enable faster response times to medical or public safety emergencies and save lives, it will improve the quality of citizen life by providing direct and personal services from the government, and it will uncover new information about how our cities work, thus enabling city leaders to use resources more efficiently and save money while providing superior services" (Clarke 2013, 4). As indicated by IDC,

the internet of things provides near endless opportunities for companies, such as Cisco Systems, a sponsor of the IDC study, to mine vast amounts of data.

Over the next 25 years, modernizing and expanding the water, electricity, and transportation systems of the cities of the world will require approximately $40 trillion, which is equivalent to the 2006 market capitalization of all shares held in all stock markets in the world (Doshi, Schulman, and Gabaldon 2007). Urban analytics promises to be a central player in the market, so much so, Kamel Boulos and Al-Shorbaji (2014, 23), state "The topic of 'smart cities' is among the hottest emerging research and business themes of the 21st century." They note that University College London (UCL) launched two new master degree programs in Smart Cities in 2014. They cite Cisco Systems CEO John Chambers keynote address at the 2014 Consumer Electronics Show in Las Vegas, where he valued the public and private sector of the internet of things at $19 billion for the following decade (Kamel Boulos and Al-Shorbaji 2014, 23). They (Kamel Boulos and Al-Shorbaji 2014, 23) state that the Cisco CEO explained that "hyperconnected cities could… transform the retail industry through smart shopping carts and virtual concierges, reduce city energy costs for streetlights, revolutionise city waste management through connected garbage bins, and change the way cities handle parking through a real-time parking finder communicating with connected parking spots." Anthony Townsend's *Smart Cities* (2013, 31), the leading book on the topic, confirms these findings; he estimated the smart city share of the $40 trillion market to be $100 billion.

The way companies like Cisco Systems and urban agencies like the City of Incheon are using the innovation of the internet of things to

constitute new patterns within the urban form appears to be yielding a new urban rule-set. Yet, as an emergent property, the newness of something like New Songdo City is marked by a lack of discursive traction for what to call the new urban form. As Taylor (2001) suggests, an urban form like New Songdo City has left the stage of being "noise" and appears to be "in" – "formation." A 2011 report published by OVUM (Green 2011, 6), an information technology consultancy, for example, states, "The idea of the smart city or community has a center but no clearly defined boundary. There is not even a general agreed terminology, with 'smart city', 'intelligent city', 'wired city', 'senseable city,' and 'smart and connected community' all used to describe similar concepts." The report states, "While no one owns any of these terms, some tend to be associated with particular vendors or linked to particular approaches." OVUM uses Cisco Systems as an example, stating, "Cisco prefers the term 'smart and connected communities' to 'smart cities', and tends to use this term to indicate an orientation towards behavior-centric implementations." The report (Green 2011, 6) asserts, "A common trend is the need to complement existing disciplines of physical urban planning with a new discipline of digital planning so that cities will have their own digital master plans."

The research consultancy Forrester (Bélissent 2010, 3) defines the smart city as a "city that uses information and communications technologies to make the critical infrastructure components and services of a city — administration, education, healthcare, public safety, real estate, transportation, and utilities— more aware, interactive, and efficient." The report (Bélissent 2010, 3) develops the definition by stating, "This new approach to urban governance is enabled by the next macro cycle of information technology innovation, which Forrester labels 'Smart Computing.'" It uses "real-time

awareness and data analytics to support better decision-making. Each system that makes up a city's infrastructure can be made smarter by enabling real-time interaction — either human or machine — to facilitate decision-making based on the data produced. In the system of systems that is a city, the potential for efficiency grows as more systems interconnect and interact. Computing technology transforms a city's core systems, enabling them to capture, analyze, and act on the data they produce. As a result, a smart city can optimize the use of and return from finite resources." Forrester (Bélissent 2010, 28) defines "smart computing' as a "new generation of integrated hardware, software, and network technologies that provide IT systems with real-time awareness of the real world and advanced analytics to help people make more intelligent decisions about alternatives and actions that will optimize business processes and business balance-sheet results."

As an emergent property within neoliberal globalization, ubiquitous urban design is a driving force in reproducing markets, technology, and investment. The driving force, arguably, is one of the more important frontiers for new markets necessary for capitalism to continue to escape from its periodic surplus capital crises. As the world's largest privately financed development project (Townsend 2013, 25), New Songdo City represents an important case study for understanding smart cities in capitalist reproduction. Halpern, LeCavalier, Calvillo, Pietsch (2013, 287) argue, "Cisco's turn to urban development and to the production of smart city models and prototypes is an exercise in creating markets for the very hardware on which the company was founded." They (2013, 282) explain how Cisco Systems is "looking for new sources of revenue and hope to

'monetize' the attentive capacity of Songdo's inhabitants. Their hope is to use this latent reserve of data gathered on users to produce services that can be paid for through advertising, electronic education, physical treatment, home telemedicine, or any number of other speculative products vying for a share of this new market. For Cisco—like Facebook, Google, and other companies that attempt to link user behavior at the interface with consumer behavior in order to monetize their vast data sets—data are the currency of this new realm, a realm envisioned as an interface for inserting and extending the sensorium." Robert Hollands (2013, 6), echoing Mark Swilling's (2011) argument about how "green urbanism" is the newest form for the commodification of the urban infrastructure, suggests that while it "might be argued that environmental sustainability is in itself progressive, it might also be suggested that it can be used to disguise another significant and growing force behind smart cities. And that is a combination of aggressive marketing strategies and huge profits to be made by major corporate ICT firms, engineering, property development and construction companies." Hollands (2013, 6) cites consultancy reports that estimate annual smart city markets ranging between $20 and $40 billion by 2020. From this perspective, the smart city is reduced to a marketing ploy that sells the techno-utopian fantasy of a quality of life purged of the dystopian threat of adding 2 billion people to the urban form (Provost 2012).

Why Now? Locating New Songdo City within the Perfect Storm

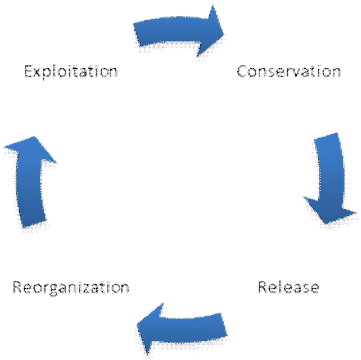
A 2013 white paper sponsored by Cisco Systems and issued by International Data Corporation (Clarke 2013, 1), a global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets, states that "Smart City development is a question of *when* not *if*, a

question of how not what. Why? Because we live in a world experiencing economic turmoil, climate change, aging populations, and rapid urbanization. But we also live in the midst of tremendous technological innovations that have the potential to address the issues that challenge every city." The IDC report invites consideration of a basic question: to what extent should we understand the emergence of smart cities like New Songdo City as the product of capitalist profit seeking through market innovation, and to what extent do we need to approach this new urban form as the consequence of the "perfect storm" (Kuecker 2014 originally published in 2007) of crises within the macro, global system? Or, do we consider the capitalist market explanation to be one of the factors in the perfect storm, whereby New Songdo City represents a symptom of the deeper structural crises of the 21st century. These questions invite us to locate New Songdo City within our current historical moment, an analysis that invites us to consider the early decades of the 21st century to be a departure from the modern world system, one driven by modernity's systemic collapse (Kuecker and Hall 2011). By this argument, we build the smart city, this new urban form, because we are leaving the modern era and are entering an era of turbulence, a factor of systemic oscillation that is tipping into processes of disordering and widespread loss of complexity. New Songdo City, by this argument, is the product of 21st century panarchy.

The idea of "panarchy" comes from the work of an ecologist, "Buzz" Holling (Holling and Gunderson 2002). It proposes a four phase cycle for complex adaptive systems, such as a forests, animals, or economies. The phases, demonstrated in Diagram One, consist of reorganization (when the system is disordered), exploitation (when emergence happens), conservation (when emergence becomes the

dominant rule-set that is pursued for relentless efficiency), and release (when the system passes from overshoot to a disordering of the system, or collapse). As a complex adaptive system, modernity is either: [1] in its late conservation phase, a time of extreme overshoot, and oscillating between reproduction and collapse; [2] at a tipping between conservation and release phases; or [3] it is in the preliminary stages of the release phase. As locating the current historical moment is of great importance to our analysis, this essay maintains that we have entered the release phase, the initial movement toward a radical disordering and simplification of the system. Yet, modernity's grasp remains firm, as we desperately attempt to prevent collapse by keeping the system within the conservation phase. Smart Cities are one manifestation of this desperate attempt to keep the system ordered. Given the complexity cycle, panarchy also maintains that a macro, global system consists of nested sub-systems, each of them global. These include systems like climate, energy, food, population, economy, and ecology. Panarchy maintains that each of the subsystems have reached their release phase tipping point, what Richard Heinberg (2010) calls "peak everything." At this moment the marco, global system experiences synchronous failure, which tips the system to the release phase where the system moves to disorder and simplification.

Diagram One: Complex Adaptive System Cycle



Source: Adapted from Gunderson and Holling, 2002: 34.

Urban design with the smart city at its core represents a significant misreading by planners about the state of the global system. They have a "sustainability" mind set that assumes the system is in overshoot, whereby urbanization is currently past a threshold of sustainability, defined as a scenario in which present forms of societal organization result in an extreme disequilibrium between sources and sinks, whereby the disequilibrium compromises present and future capacities for reproduction (for sources and sinks, see Meadows 2008). Consultancy reports on smart cities frame their analysis with the overshoot scenario and the need for sustainability. McKinsey and Company (Elfrink 2012), for example, frames the sustainability challenge around peak demographics: "Our rapidly urbanizing world faces an enormous demographic imbalance. Over the next few decades, Europe, and to some extent the United States and China, will be aging and shrinking, even as India, Africa, and the Middle East see their populations expanding. At the same time, we still have three

billion people in the world who have no access to water, electricity, health care, and education. And we are moving from a global population of seven billion to nine billion." The McKinsey report emphasizes, "Clearly cities are the key to whether we successfully meet this massive transition challenge and achieve growth that is both sustainable and inclusive. And the critical enabler is going to be technology." Forrester Research, Inc. (Bélissent 2010, 2) shares the demographic frame, and shows its impact in driving peak everything within key sub-systems within the urban metabolism: "More people means competition for limited resources and eventual scarcity. Demand for water and energy illustrates these pressures. In 1990, 20 countries faced water scarcity — up from only seven in 1955. By 2025, an additional 10 countries — and by 2050, another four — will face water scarcity, accounting for a total of 18% of the world's population. Another 24% will experience water stress or shortage. Combined, that's almost half the world's population — with most in developing countries. The demand for energy use is also growing more rapidly in developing countries. The Organisation for Economic Cooperation and Development (OECD) estimates that energy consumption will increase by 84% in non-OECD countries, compared with a 14% increase in energy use among the 33 OECD countries. The two largest uses of energy consumption are industry and transportation, both of which are expected to increase more rapidly in non-OECD countries." Leading design firms, such as Arup International, join this perspective. Their September 2010 report, "Smart Cities: Transforming the 21st Century Via the Creative Use of Technology," (4) states: "The challenges of climate change, population growth, demographic change, urbanisation and resource depletion mean that the world's great cities need to adapt to survive and thrive over the coming decades. Slashing greenhouse gas

emissions to prevent catastrophic climate change while maintaining or increasing quality of life could be a costly and difficult process. There is an increasing interest, therefore, in the role that information and communications technologies could play in transforming existing power-hungry metropolises into low-carbon cities of the future. But, as yet, few cities have fully grasped the possibility of becoming a 'smart city'"

Smart cities are an adaptive response to the perfect storm, where planners assume the system of modernity can be saved by scaling back the system from its extreme overshoot and landing it in a steady state of system equilibrium. Positive feedback loops within the global complex system, however, send signals to urban planners and developers that they should relentlessly pursue efficiency within the capitalist rule-set, while constructing significant economic, political, social, and cultural signals that prevent it from embracing policies and actions that would cause system stabilizing negative feedback loops. By this analysis, a smart city like New Songdo City, especially due to the strong market forces driving innovators like Cisco Systems, constitute a positive feedback loop that will drive the modern system deeper, faster, and harder into its release phase. Lacking a system operating by negative feedback loops, cities, along with the rest of the global community, will drive itself into a hard, species threatening collapse. Smart Cities constitute mal- adaption to the perfect storm, and are far from the "eco-city" urban form advocated by visionaries like Richard Register (2006) or the fundamental paradigm shift envisioned by Donella Meadows, Joregn Randers, and Dennis Meadows, in their *Limits to Growth* (2004) call for a "sustainability revolution."

One way to think about emergent properties in complex adaptive systems is to consider the evolution of transportation from horse to railroad. For centuries the dominant means of terrestrial transportation was the horse. Horse transport defined time-space relationships in both absolute and relative/abstract forms (on time-space relations, see Gregory 1994). Central to time and space, horse transport was constitutive to society, and was common sense for how the world operated, especially within the practice of everyday life. The horse was the typewriter and telephone before the computer and internet. A transportation revolution happened in the early 19th century with the "iron horse" or "railroad." It caused a radical reworking of relative/abstract space, that compressed time-space in ways not seen for millennium. It was the 19th century's internet revolution, and it was a fundamental force shaping modernity. To get to the railroad, a process of innovation took place, such as the one represented in Picture Two, which is an engineer's design for what he imagined to be what we now know to be the railroad. It required assembling existing technologies, such as steel rails, gears, wheels, and the steam engine. Putting the pieces together, however, also required an epistemological shift, one that displaced the horse centered paradigm of transportation, with a new way of thinking, being, seeing, and acting of the railroad age. At the tipping point, the new parts are in play, but the old way of thinking, the "horse sense" that says "if it is transportation, it must have the horse," is still dominant, and prevents the tipping to the new paradigm from happening. The horse, however, absurd, had to be central to the new form of transportation, because if you were doing transportation, the horse had to be involved. The horse, on the conveyor belt, on the railroad track constitutes a metaphor for paradigm shift, cultural hegemony, and the larger process of societal transformation.

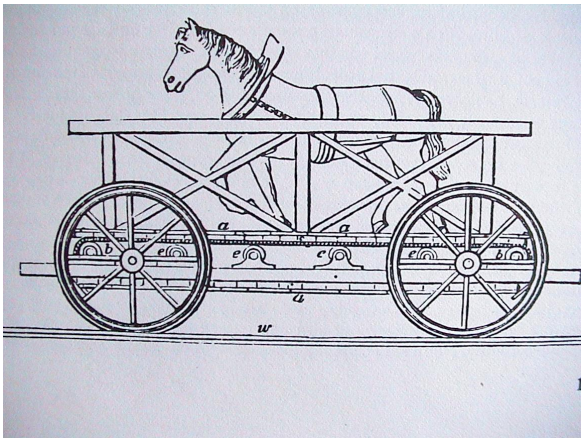


Figure 2. *Engineer plan for railroad, circa 1829.*

New Songdo City, then, is the horse on the conveyor belt on the railroad track. As with the transition to the railroad, today's smart city remains in a process of experimentation, testing, and exploring (Townsend 2013). The final form is unknown, and the complete transformation in thinking, the epistemological shift away from "horse thinking" has not yet taken place. Townsend (2013) maintains tha how that shift will happen remains an open question, as well as when, or even if it will happen in a timely fashion.

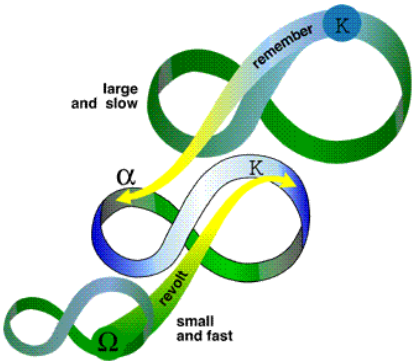
One insight into how the smart city transition might happen comes from consideration of Dennis Kingsley and John Urry's (2009) *After the Car*. In this book the authors use complexity thinking to analyze

the historical emergence of the car system. They illustrate how it became central to the larger macro, global system of 20th century modernity, and make the case for how the system integrates the physical metabolism of energy and material consumption with human systems of production and consumption in forming a rule-set that constitutes one of the deepest cultural paradigms of late modernity. More significant for thinking about smart cities is their argument that a new car system is in the process of emergence. They maintain that relatively random components of the macro global system are forming new patterns that are showing signs of a new rule-set that will soon set the foundation for a new system that will launch the next wave of transport revolution. They illustrate how new fuel systems, new materials, smart vehicles, digitalization, de-privatization, new transport policies, new living practices, and disruptive innovation are coming together to tip the modern mode of car transportation into something radically new and different. If we tip past the point of modernity's car based transport system, the resulting emergent property will fundamentally re-define our ways of being, seeing, thinking, and acting, and will constitute the basis for the sustainability revolution called for by Meadows, Randers, and Meadows. Google's development of the driverless car, soon to be on the road in California, suggests that the tipping point has arrived (Muller 2013). Yet, that "if" is a very big "if."

Kingsley and Urry's post-car system highlight another perspective to the panarchy concept, one that sheds more light on the challenges of understanding what may happen to the macro, global system at its critical threshold where panarchy finds the late conservation phase's extreme overshoot resulting in modernity's tipping into a post-modern release phase. They show that the system's emergent properties, even in the relative rigidity of the late conservation, where the system

is locked into a death spiral of the relentless pursuit of efficiency within the rule-set, can persist as a complex adaptive system by evolving within the modern rule-set to a newer, higher stage of systemic reproduction that avoids collapse while transitioning into a new system. Presumably this new system state would pass through the critical threshold, avoid entering the release phase, and tip into a new reality, one that would be radically distinct from the previous system of modernity. This emergent process of evolution would also constitute a post-modern proposition, but it would not entail collapse.

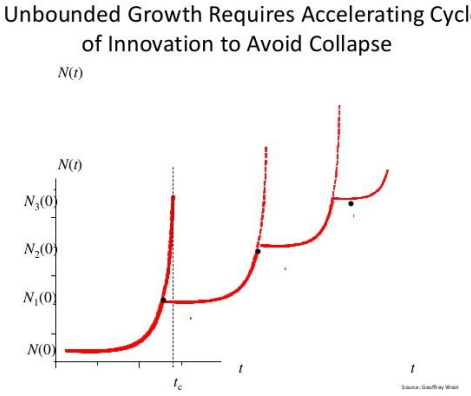
Diagram Two: Emergence as panarchy



The evolutionary perspective is advocated by Geoffrey West, a physicist at the Santa Fe Institute, one of the leading think tanks for complexity studies. In his Ted Global 2011 presentation, "The Surprising Math of Cities and Corporations," seen by over 1.2 million viewers, West explains how cities can prevent a "limits to growth" collapse by innovation. "What we do is, as we grow and we approach

the collapse, a major innovation takes place and we start over again, and we start over again as we approach the next one, and so on," according to West (2011, 14:50).

Diagram Three: West's unbounded growth as a possible path of emergence.



West, however, recognizes that while innovation driven unbounded growth can avoid collapse, it still faces deep predicaments. "So there's this continuous cycle of innovation," West states, "that is necessary in order to sustain growth and avoid collapse. The catch, however, to this is that you have to innovate faster and faster and faster. So the image is that we're not only on a treadmill that's going faster, but we have to change the treadmill faster and faster. We have to accelerate on a continuous basis" (West 2011, 14:50). This "catch" is no minor thing, as it returns us to the limits of growth, and strongly suggests that smart cities remain firmly bounded by the laws of thermodynamics that warn us against devising open loop systems that require perpetual growth. The catch negates the more optimistic interpretation of New Songdo City put forward by Townsend (2013,

28), which endorses the "bridge to the future" concept. He sees New Songdo City as planting the seeds for future smart city successes. The catch, points to a consistent problem within modernity first recognized by William Stanely Jevons, in his 1865 *The Coal Question*. Jevons argued that technology driven gains in efficiency that intend to conserve resources paradoxically result in increased consumption (Hallett 2013). Likewise, Thomas Homer-Dixon, invites us to see the limitations of innovation as solutions to crises in complex adaptive systems. In his *Ingenuity Gap*, Homer-Dixon (2002) illustrates that when we innovate to solve problems caused by the complex systems we create, we make the system even more complex. A positive feedback loop of problem, innovative solution, enhanced complexity becomes part of the late conservation phase rule-set, a factor that drives the system to extreme overshoot, while making it more rigid and decreasing its resilience, especially its ability to emerge into a new system. While we can see the innovative solutions to system problems as constituting an emergent property similar to West's vision of collapse escaping systemic evolution, Homer-Dixon argues that eventually the system will become so complex and the problems, the "unknown unknowns" it throws at us will scale beyond our capacity to successfully adapt. As West argues, eventually, we will not be able to bridge the ingenuity gap fast enough to escape collapse.

Discerning if New Songdo City is a factor of the ingenuity gap, the efficiency trap, or both, is largely a question of interpretation. Yet, those options tell us that as an emergent property, New Songdo City and the smart city form of urbanism is an innovation that reproduces the modern system, keeping it within a positive feedback loop of extreme overshoot that will eventually tip into collapse as against an emergence that crosses thresholds into a new system without

collapsing. New Songdo City is not the bridge to the future that its creators represent it to be. Instead it is a collasal example of maladaptation, an errant form of emergence that wastes billions of dollars and vast amounts of social capital on building the wrong urban form at a critical moment in human history.

Steven Johnson's (2001) analysis of emergence makes the case that it is a process of self-organized becoming that happens without a master plan, leadership, or design. He uses the example of ant colonies, and the "myth" of the queen sending orders to the worker ants that make the colony function. Instead of this pacemaker, the ant colony self-organizes from the collective behavior of the colony, a process that manifests a capacity for adaptation that approaches learning. For Johnson, there is no pacemaker in emergence; it is a bottom-up rather than top-down process. Many observers negatively critique smart cities, especially New Songdo City, for being a top-down pacemaker. Dan Hill (2013), for example, refers to the smart cities as the "urban intelligence industrial complex" led by the likes of Cisco Systems, IBM, Siemens. Hill, echoing Townsend's (2013) analysis, juxtaposes the top-down urbanism of current smart cities like New Songdo City with the bottom-up vision of "smart engaged citizens." He asks, "is there a tension between the emergent urbanism of social media and the centralising tendencies of urban control systems?" Hill has in mind the people centered smart urbanism developed by Adam Greenfield, especially his Urbanscale project (http://urbanscale.org), and as articulated in his *Against the Smart City* (2013). They take from Richard Sennett's damning 2012 assessment, "a city is not a machine; as in Masdar and Songdo, this version of the city can deaden and stupefy the people who live in its all-efficient embrace. We want cities that work well enough, but are open to the shifts, uncertainties, and mess which are real life." The

critique of top-down urbanism engages the ghost of the epic battle between Jane Jacobs and Robert Mosses over the future of New York City's essence. The debate between serendipity and planning reaches back to the authoritarian modernist planning of Haussmann's redesign of Paris (Harvey 2006), as well as the high modernism of Lúcio Costa and Oscan Niemeyer's design for Brasilia (Holston 1989) and Le Corbusier's five points of architecture. The top-down vs. bottom-up tension with smart cities also suggests the dystopian potential of high modernism as explained by James Scott in his *Seeing Like a State* (1998). Steven Poole (2014), writing for *The Guardian*, explores the utopian vs. dystopian tension in our understanding of the smart city, and concludes that their top-down propensity will eventually destroy democracy.

The True Believers

The top-down vs. bottom-up debate over smart cities is acknowledged within the consultancy community. OVUM (Green 2011, 8), for example, explains, "Another tension that runs through the various initiatives is the differences between the top-down and bottom-up approaches to digital urban renewal." In their perspective, "the respective distinction between the top-down and bottom-up models is a 'tight' approach, which involves monitoring, instrumentation, and centralized control, and a 'loose' approach, which focuses on enablement, community involvement, and behavioral change. The paradigm for a top-down approach is a tightly managed enterprise resource planning system for the entire city, including its distributed physical assets. The paradigm for a bottom-up model is an open source platform that supports instead of prescribes the creation of modular and diverse applications and extensions by third parties."

Smart City defenders, such as Rick Robinson, an executive architect at IBM specializing in smart cities, and whose Urban Technologist Blog (http://theurbantechnologist.com) advances ideas for making the smart city idea work, vigorously argue against the naysaying dystopian thesis. Simply stated, he argues that "No-one wants top-down, technology-driven cities. They'd be dumb, not smart." Robinson asserts, "In all of my contacts across the world, in technology, government and urban design, I don't know anyone who thinks it would be 'smart' for cities to be run wholly by technological systems; who believes that digital data can provide 'perfect knowledge' about city systems; or who thinks that cities built and run entirely by deterministic plans driven from the top down would be healthy, vibrant places to live (or indeed are possible at all)." Robinson attempts to reframe the top-down vs. bottom-up smart city tension by avoiding its either-or dichotomy by seeing them as complimentary processes. "From the governance of cities, to the policies that affect investment, to the oversight, administration and operation of city infrastructures," Robsinson states, "these processes work top-down; and in order for us to rely on "bottom-up" creativity improving cities for all of their citizens, we must adapt and improve them to better support that creativity." Robinson thinks Jacobs and Mosses can ride off together into the smart city sunset.

When meeting with Gale International executives in their New York City office in May 2013, I gained insights to the "true believer's" mentality carried by smart city advocates. When CEO Stan Gale sold off company assets to help finance the project, the Gale International team had gone "all in" on the project. When I asked about low occupancy rates, media reports of a lethargic city life, and their top-down design approach, the executives spoke directly about the cultural dynamics of urban formation. They discussed how the plans

can be made, the buildings built, and the infrastructure placed, all with the intent of creating a "smart" and "sustainable" city. Yet, they framed New Songdo City's future as resting within the Jane Jacobs (1992/1961) urban frame, one that recognizes the street level as against the master planner's drawing board. They embraced the idea that the city will be made by its inhabitants, the culture they bring, and the intangible interactions of their collective lives. Their observations suggest the idea of emergent properties, but their desire for a bottom-up, street level city culture conflicts with Gale International's dual propensity for top-down master planning and its attempt to copy iconic architecture and landscapes from the great cities. For the master plan, Gale contracted the global architectural firm, Kohn, Pedersen, and Fox, which generated the blue prints for the instant city. Together, they created the simulacrum landscape of iconic structures and places copying from New York City's Central Park, the Sydney Opera House (see Picture Three), and even the canals of Venice. Emergence, as Johnson (2001) explains, is an organic process, a patterning from random interactions that does not have a pacemaker planning and overseeing the process of becoming. With Gale International, Kohn Pedersen and Fox, Cisco System's, New Songdo City clearly has pacemakers. Built from scratch – except for the ecosystem it landfilled-- the city came into being direct from the design table, without any inhabitants to generate a bottom-up, self-organized process of urban becoming. This top-down smart urbanism significantly limits the self-organizing, serendipitous capacity of the urban form from escaping the death spiral of modernity's extreme overshoot.

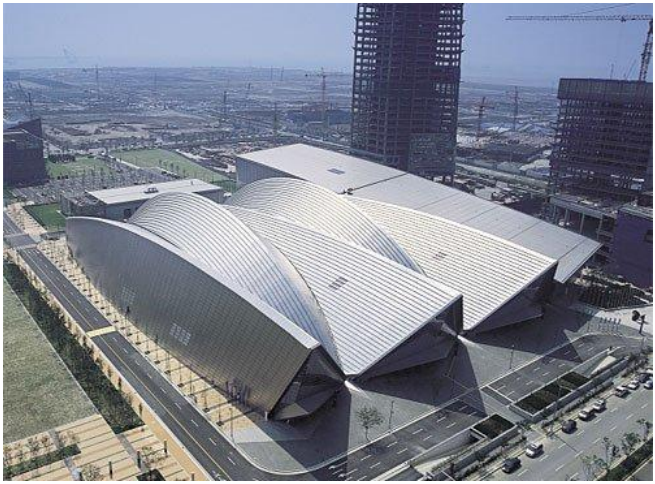


Figure 3.Kohn, Pedersen, Fox' Convensia, a simulacrum of the Sydney Opera House

Obedient to the laws of thermodynamics, a collapsing system experiences loss of complexity and a move from order to disorder. To prevent the collapse, human agents within the extant system expend energy through their interventions to keep the system ordered. Complexity thinkers like Joseph Tainter (1988) and Homer-Dixon (2006) argue that the system will experience diminishing returns, as more and more resources are poured into sustaining a system that would otherwise become disordered. This sustaining gesture rests at the core of the smart city epistemic, one deeply rooted in a Cartesian mindset that views the non-human world as a machine, where nature can be controlled by reason (Best and Kellner 1997). This epistemic reduces nature to an instrument or tool for human purposes. The instrumentalist view of nature sees the world

in a linear fashion in that it attempts to reduce the randomness, spontaneity, disorder, and chaos of a non-linear universe to knowable universals, civilizational myths disguised as truths that make human dominion over nature not only possible but a necessary facet of the human condition (Quinn 1999). With global crises bringing our oscillating system to the edge of chaos, Gale International's New Songdo City is the product of the Cartesian epistemic, an attempt blind to the desperation of the gesture to restore order to modernity's collapse.

Emergence and the Right to the City

Emergence is important because it is the core of resilience, a resource in great demand if we are to avoid a hard collapse of the macro, global system. The source of resilience is the commons, especially the social, political, economic, and cultural relations relations built by humans. The late conservation phase, however, brings us to a relentless pursuit of efficiency within the economic rule-set, neoliberal globalization. For the past 40 years, neoliberal globalization at ever great speeds and depths has penetrated all scales and spaces of the commons, leaving a social fabric torn to shreds precisely at the moment that it is most needed, and leaving us dependent upon capitalism to save us from the crises it had created. As Naomi Klein's *The Shock Doctrine* (2008, also see Keucheyan 2014) informs, capital thrives on the profit making potential of crises. As neoliberalism continues to transition capitalism to its green iteration (Swilling 2011), the commons continues to be privatized, as clearly illustrated by the case of New Songdo City, an instance of an urban form constituted as privately held public space. As Hollands (2013, 3) states, "The problem in urban sociology generally is there appears to be a distinct lack of an alternative to the neo-liberal city, smart or otherwise." Looking for the urban equivalent of the Zapatista

movement, the ways that "other knowledges" can generate alternative urban forms suggests how smart cities like New Songdo City block their emergence. Arguably, spaces like slums is one such zone of liberation, as well as squatter communities, such as the Frente Popular Pancho Villa ("Los Panchos") autonomous *comunidad popular* in Mexico City's Acapatzingo barrio (Zibechi 2014), or Torre David in Caracas (see Picture Four), where impoverished city dwellers occupied an skyscraper-office complex abandoned after being two-thirds constructed due to a the developer's bankruptcy, and transformed it into a vertical squatter community (Baan 2013).

Figure 4. Torre David in Caracas.

Responding to the crisis of post-war capitalism and its detrimental impact on Parisian urban form, and anticipating 1968, Henri LeFebvre (2003) argued for the "right to the city." LeFebvre's formulation provides deeper insight to emergence, as the "right to the city" is the urban dwellers right to transform the city and to be transformed by the city (Harvey 2012; and Merrifield 2013). Boosters of the smart city

embrace the techno-utopian potential human transformation and consequent systemic emergence toward the enlightenment's continued perfection of the human condition. The dystopian view understands smart cities to be a denial to the right to the city. Them New Sondgo City portends a new era of splintered urbanism (Graham 2001; and Swilling 2011), a global apartheid of gated smart cities protecting a global elite in what Hodson and Marvin (2010) call "bounded urbanism" from the global slum (Davis 2007). Hollands (2013, 11) argues that "smart city initiatives stop" the "right to use technology." Instead, he advocates for "the right to shape the city using human initiative *and* technology for social purposes to make our cities better and more sustainable." Hollands' analysis is echoed by Townsend's (2013) call for a bottom-up approach of smart technology citizens using the internet of things to constitute a new civil society.

Conclusion

In complexity thinking, systems abide to the laws of thermodynamics. Entropy tells us that any system's propensity is toward disorder. Cities, as Edward Glaeser (2012) reminds us are humanity's "greatest invention," a remarkable way to bring order to the complexity of human agency. When systems reach the critical threshold of their tipping point, emergence becomes critically important in determining the potential outcomes of the tipping. This essay considered smart cities, such as New Songdo City, as constituting the newest wave of Glaeser's greatest invention, by charting three potential emergent outcomes. The first path maintains that smart cities are an emergent property that fails to prevent systemic collapse, largely due to their lack of resilience caused by their neoliberal assault on the commons. The second path of panarchy finds smart cities as tipping the system into an entirely new system. In this scenario, the new system comes into formation without the midwife of collapse. The third path

maintains that as a “unbounded growth” emergent property, smart cities keep us in sustained, extreme overshoot, where New Songdo City represents the relentless pursuit of efficiency within the late conservation phase’s capitalist rule-set.

As urbanization increasingly becomes a pressing issue within the 21st century’s perfect storm, the question of the smart city’s relationship to emergence speaks directly to one of the bigger debates in urban studies. One side maintains cities are the location of 21st century resilience and they key for weathering the perfect storm, while the other sees the urban form as exacerbating modernity’s systemic collapse. The smart city undoubtedly will play an important role in determining if cities are our savior or curse. New Songdo City suggests early bets on the curse may prove the winner.

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