Figure 1 Songdo International Business District under construction, Incheon Free Economic Zone, South Korea, July 6, 2012. (Image: Jesse LeCavalier)

Test-Bed Urbanism

Orit Halpern, Jesse LeCavalier, Nerea Calvillo, and Wolfgang Pietsch

We also have houses of deceits of the senses, where we represent all manner of feats of juggling, false apparitions, impostures and illusions, and their fallacies. And surely you will easily believe that we, that have so many things truly natural which induce admiration, could in a world of particulars deceive the senses if we would disguise those things, and labor to make them more miraculous.
Sir Francis Bacon, *New Atlantis*

The implementation of the U-City (Ubiquitous City) system based on IT technology . . . allows you to take part in daily tasks more quickly and efficiently whenever and wherever you want. Your life will be more comfortable with technology you never experienced before.
Incheon Free Economic Zone, *We Build Success* brochure

There is a new New Atlantis rising from the sea. This is a city that, like the seventeenth-century utopia of Bacon's imagination, is purported to support the future of science, art, and commerce. The forms of experiment and rationality that govern this territory are, however, distant from the enlightened reason and empirical experimentation of Bacon's envisioned ideal society. This territory will be governed not by a concentrated group of advanced leaders but by a diffuse network of machines.

The city is called Songdo. It is one hour's drive southwest from Seoul and is

Public Culture 25:2 DOI 10.1215/08992363-2020602

being built from scratch on land claimed from the ocean. Songdo is one of a trio of cities that make up the Incheon Free Economic Zone (IFEZ), a development initiated by the Korean government to attract foreign investment and residents. Songdo's distinguishing feature is the promise of its ubiquitous physical computing infrastructure. Marketed as a "smart city," it is presented as an entire territory whose mandate is to produce interactive data fields that will, like the natural resources of another era, be mined for wealth and, similarly, will generate subsequent infrastructure for new forms of life. The city is envisioned as a physical incarnation of an immense cloud of big data; its purpose and value are generated by speculation on how sensitive its infrastructure of sensors and cellular communication towers is, on how much data the city can generate, and on how capable its high-bandwidth conduits are to circulate these data. IFEZ is like a holding company that is testing and refining a fleet of commodity cities that are imagined as mobile, plastic territories. They are simultaneously software, hardware, screen, algorithms, and data (Crang and Graham 2007), serving as interfaces and conduits into networks linked to other territories. These cities, like computational algorithms, are clearly defined and replicable: they are the protocols of a global infrastructure of information and economy. As a leading example, Songdo offers a unique vantage point from which to examine this global cultural and economic logic of large data sets.[1]

Like New Atlantis, governed by a specific scientific practice of empirical experimentation, Songdo is also touted as an ideal site for new forms of experimental practice. For example, Songdo has been referred to as "the experimental prototype community of tomorrow" (see Kasarda and Lindsay 2011: 4; and Lindsay 2010: 90). Furthermore, implicit in our discussions with Cisco, Songdo is understood as a model that can be bought, replicated, and deployed (Choi, pers. comm.). However, unlike the older forms of Enlightenment science, this experiment does not subscribe to the same rules. We argue that Songdo is reflective of a new form of epistemology that is concerned not with documenting facts in the world, mapping spaces, or making representative models but rather with creating

1. Much of this information was gathered from site visits to Songdo and Seoul on July 1–8, 2012. We visited Digital Media City Showroom on July 2, 2012 , and spoke to Professor Dr. Donyun Kim of Sung Kyun Kwan University at Samoo Architects and Engineers on July 3, 2012. We interviewed Tae kyoungIm, senior manager, network operations business, Public Business Office, Smart City Business Team at SKtelecom on July 5, 2012. We visited IFEZ on July 4 and spoke with Jongwon Kim of the U-City Business Division of IFEZ and Kyung-Sik Chae of the Culture and Arts Division from Incheon Metropolitan. On July 6, we met Tony Kim, director, Internet Business Solutions Group (IBSG), Cisco Systems Korea, and Gui-Nam Choi, a services sales executive of Cisco Systems Korea. We are very grateful for their help and generosity.

models that *are* territories. Performative, inductive, and statistical, the experiments enacted in this space transform territory, population, truth, and risk with implications for representative government, subjectivity, and urban form. These features of what we are calling "test-bed urbanism" are increasingly evident globally, both in new "smart city" projects (Hollands 2008; Ho Lee et al. 2008) and within the discourse of urbanism more generally (Augé 1995; Office for Metropolitan Architecture, Koolhaas, and Mau 1995: 1238–67; Elden 2007). We argue that this test-bed urbanism is a form of administration and a redistricting of bodies and information into new global configurations that are increasingly affecting all our lives and therefore demand explication. We do this by first examining the operations "on the ground" at Songdo in order to assemble initial evidence in support of our concluding speculative claims concerning the epistemology of the test-bed city.

Finally, Songdo, unlike other ideal cities whether built or unbuilt, has no perfect whole and thus is both literally and conceptually incomplete. However, it remains utopian in the sense that it aspires to achieve new forms of life, even in a perpetually provisional version (Gordin, Tilley, and Prakash 2010). This city is a rehearsal of our future and an archive of our past. The purpose of this essay is to excavate this wishful thinking and to examine the tense relationship between performance and aspiration. Like all utopias, Songdo is also a "heterotopia," a space that can tell us about our world, make us conscious about the choices — aesthetic, architectural, designed, and technical — that we are making and still have to make. Most importantly, these mirror worlds — dystopian, ugly, banal, beautiful — provide us with visions of alternative realities and portents of events we might seek to avoid (Foucault 1986). Such nonspaces make us realize that what we assume to be natural — the desire, for example, for a "smart" planet — is contested, situated, and historically specific. The present is not known, and the future is not already here.

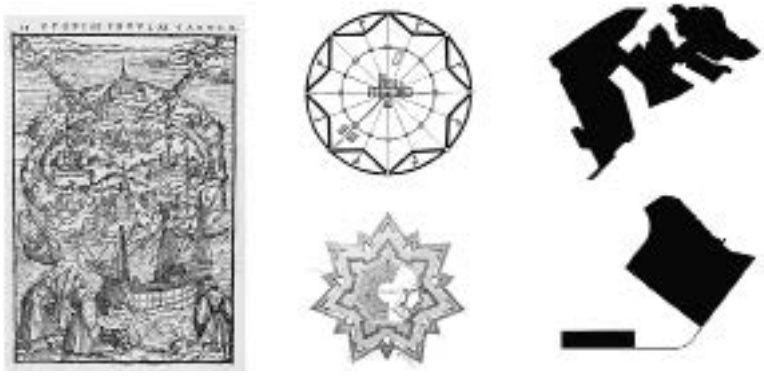

Figure 2 Utopian urban forms have changed from ideal to performance-based geometries. Left: frontispiece for Sir Thomas More's *Utopia* (1518) by Ambrosius Holbein; upper middle: Sforzinda by Filarete (15th–16th century); lower middle: Coevorden (the Netherlands, early 17th century); upper right: Jurong Island, Singapore; lower right: Songdo.

Arriving on New Shores

The phrase *smart city* can be feasibly applied to a large number of diverse international projects that range from the updating of telecommunications infrastructure to the construction of entirely new, planned cities. Robert Hollands (2008: 304) points out that already in 1997 the World Forum on Smart Cities suggested that there would be fifty thousand cities and towns working on smart initiatives by 2010. The common denominator in most of these projects is an investment in digital infrastructure and a belief in the possibility of "improving life through technology" (Living PlanIT 2012). These projects operate at a range of scales: from the development of a 225,000-person "smart valley," as in Portugal's Living PlanIT project, to 2.5 million people projected to eventually settle in Songdo, one of the largest smart city projects to date. Gale International, a Boston-based real estate company, is developing Songdo with the support of the Incheon municipal government. The new city is part of the larger IFEZ, a new juridical designation

Figure 3 Promotional material from IFEZ uses an aerial perspective to show the extents of the development. In the upper right, the Incheon Bridge and international airport beyond are visible. (Image: Incheon Free Economic Zone, *We Build Success* brochure, 3)

that also includes Cheongna and Yeongjong. Songdo is connected to the Korean mainland by electronically monitored bridges and is strategically located close to Incheon International Airport. IFEZ actively courts foreign investment and labor through significant tax incentives, logistics capabilities, leisure opportunities, and the promise to be one of the world's "smartest" urban regions (J. Kim, pers. comm.). In pursuit of this goal at Songdo, Gale enlisted the San Jose–based networking company Cisco to develop many of the smart technologies and services and the attendant infrastructure (Lindsay 2010; Cortese 2007).

Famous for building routers and infrastructure for networks, Cisco now aspires to become a management consulting corporation, with the expertise to build the informational infrastructure for cities of millions of people overnight. Its main concern is increasing the demand, therefore, for bandwidth. It hopes to produce, what its competitor IBM has labeled, a "smart" planet.[2] Cisco Systems was founded in 1984 by Leonard Bosnack and Sandy Lerner, with an early expertise and eventual effective monopoly on networking devices and management. However, in 2006 the company changed its name to simply "Cisco" and began focusing on a wider range of service provision. John Chambers, the chief executive officer at Cisco's global operations, asserts in reference to the above services: "We used to be a plumber . . . but now we've moved from plumbing to being a platform for innovation" in order to suggest to governments or other actors how they might "use this technology to change societies" (quoted in Lindsay 2010: 92). As part of Cisco's rebranding and diversification efforts, it initiated its Smart+Connected Communities (S+CC) program in 2009. According to the Cisco S+CC "Media Backgrounder" (2011b: 10), the program is a "holistic blueprint" and a "global initiative using the network as the platform to transform physical communities to connected communities run on networked information to enable economic, social and environmental sustainability." Cisco has been aggressive about its S+CC project and is developing different aspects of it in numerous countries and with a range of international partners. The network-hardware-provider-turned-urban-development-consultant has projects in major cities in countries that include South

2. IBM (2012) has an entire new management consulting service branded around "smart planet" services. Cisco is planning to also retrofit itself into a more consulting service–oriented company rather than mainly selling hardware like routers for digital infrastructure. In building these cities, Cisco's role is largely as the management consulting and strategy firm for high-tech services. The conduits, routing systems, sensors, telecom towers, and other hard portions of the infrastructure are built by telecom companies with which Cisco collaborates. In this case Cisco partnered with Korean Telecom (KT), and the buildings are built by Gale International, a Boston-based developer, with architectural design by Kohn Pedersen Fox, a global architecture firm with six offices in New York, Shanghai, Hong Kong, Seoul, Abu Dhabi, and London. (T. Kim and Choi, pers. comm.).

Figure 4 In order for Songdo to deliver the services promised, it requires a network with sizable data rate capacity, that is, bandwidth. This increased demand for the provision of network infrastructure is one of the attractions for Cisco. (Image: Incheon Free Economic Zone, *We Build Success* brochure, 5)

Korea, the United States, Spain, England, the Philippines, the Netherlands, China, Mexico, Canada, India, Portugal, Russia, Vietnam, Kuwait, Malaysia, and Saudi Arabia and continues to expand as we write. Cisco's list of partners is almost as long as the number of countries in which it is active. However, since most are highly specialized digital infrastructure providers, none of them are especially well known. Gale, in partnership with Cisco and the Korean construction company Posco E&C, is trying to change that.

At the center of Songdo's marketing materials and technical discourse lies a fantasized transformation in the management of life — human and machine — in terms of increased access to information and decreased consumption of resources. As some of its more enthusiastic proponents write: "New Songdo is the most ambitious instant city since Brasília 50 years ago. . . . It has been hailed since conception as the experimental prototype city of tomorrow. A green city, it was LEED-certified from the get-go, designed to emit a third of the greenhouse gases

Figure 5 "Life in the Incheon Free Economic Zone is peaceful and abundant with parks and broad fields of green covering more than 30% of the city. There is a new city waste incinerating facility, a treated sewage recycling system and other systems, which work beyond eyeshot." Sustainability is the narrative twin to "bandwidth" in Songdo's promotional material. The reduction of resource consumption through an increase in data consumption provides justification for future investment in research and growth. (Image: Incheon Free Economic Zone, *We Build Success* brochure, 4)

of a typical metropolis its size. . . . And it's supposed to be a 'smart city,' studded with chips talking to one another." The article goes on to address the role of Cisco in the project and its plans to "wire every square inch of the city with synapses" (Lindsay 2010: 90). The developers, financiers, and media boosters of this city argue for a speculative space ahead of its time that operates at the synaptic level of its inhabitants. So, for example, there is a great predilection for implanting LED screens everywhere and pushing video conferencing to be integrated with other bio- and labor-monitoring devices. Video demands high bandwidth above and beyond all other media formats. Cisco's strategic planners envision a totalizing sensory environment in which human actions and reactions, from eye movements

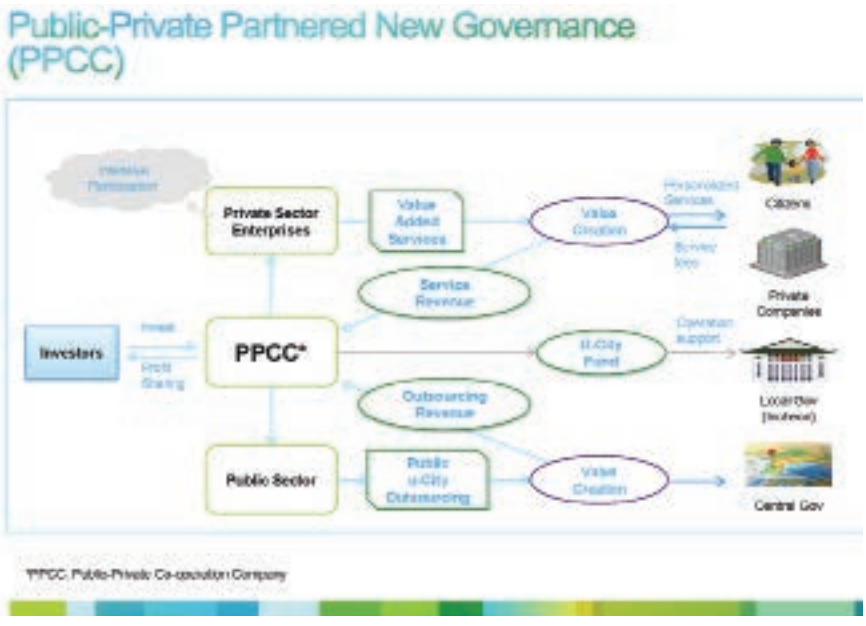

Figure 6 The PPCC creates new sources of revenue by creating tiers of digital services for both individuals and for governments. (Image: Cisco 2012b: 13)

to body movements, can be traced, tracked, and responded to in the name of consumer satisfaction and work efficiency.[3] Every wall, room, and space is a potential conduit to a meeting, a separate building, a remote lab, or a distant hospital. The developers thus envision an interface-filled life propelled and organized by a new currency of human attention at its very nervous, or even molecular, level.[4]

This manipulation of synapses — both those of the city and those of its inhabitants — is closely linked to a second discussion about the resulting outgrowth of sustainability as a guiding principle. Consequently, the two discourses that shape the speculation around Songdo and offer insight into the infrastructural logic of

3. Of those we spoke with at IFEZ and Songdo, most agreed that no one could really define these terms, but they were useful as a goal and an ideal. It is also worth noting that whatever these terms may denote, they are always extendable, as, incidentally, are the concepts of "intelligence" and "smartness."

4. The interviews at IFEZ and Cisco both included marketing videos showing the rollout of telemedicine applications. Some engineers even spoke of transforming the laws of South Korea to permit the construction of medical-grade networks to allow genetic and other data to flow from labs in the home to medical sites in the proliferation of home health-care services (J. Kim, pers. comm.; T. Kim, pers. comm.).

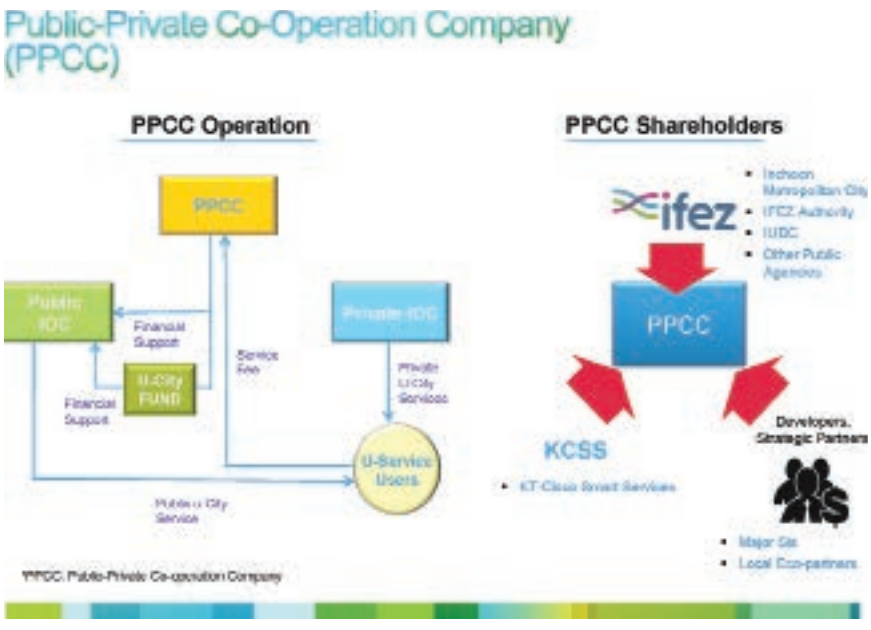

Figure 7 In the case of Songdo, the PPCC comprises IFEZ, individual inventors, and a joint partnership between Korean Telecom and Cisco. (Image: Cisco 2012b: 12)

digital media are those of, on the one hand, preparedness for possible ecological disaster (i.e., *sustainability*) and, on the other, an expanding capacity for attentive manipulation and management of information, resources, and inhabitants (i.e., *bandwidth*). The latter stretches into the very minds of the city's inhabitants, who, incidentally, are also increasingly imagined as components in an urban-cum-global network. From this infinite set of biological, machinic, demographic, and environmental data, a fantasy of self-regulating and self-propagating systems emerges. This is a city that may not be fantasized as conscious but certainly fantasized as something capable of intelligence and cognition by way of modulating and measuring the affective states and senses of its many inhabitants — human, machine, or otherwise, a notion reinforced even by the adoption of the term "ubiquitous" to describe the city's impulsive and subconscious operations (Weiser 1991; Ho Lee et al. 2008).

In spite of its claims of greenness and smartness, Songdo remains challenged by its profit motives and is breeding new entrepreneurial opportunities and institutional structures as a result. In Songdo, Cisco and IFEZ are experimenting with the construction of a joint venture between public and private companies by which

the private sector invests in new data infrastructure with the promise of accessing and using public data in return. Cisco has acknowledged that some of the challenges to "service implementation" include "unclear added value of u-services ["ubiquitous" services, which include any service envisioned to be delivered or managed through the high-bandwidth infrastructure such as tele-medicine, energy monitoring, temperature controls, electricity, water, and so forth], difficulties in funding for operation, and low-quality of service" (2012b: 4). To help overcome these obstacles in the past, the company has turned to what it refers to as "traditional monetization alternatives" including either "subsidies from city government to pay the services operator [i.e., Cisco] to operate/provide the service to the citizens" or "developers' subsidies/investments to cover a portion of the expenses considering the potential increase of land valuation resulting from service provision" (Cisco 2012b: 4). With Songdo, Cisco is developing a new model of public-private cooperation including the formation of a public-private cooperation company (PPCC) that comprises a joint venture between Korean Telecom and Cisco; the IFEZ, which includes the Incheon Metropolitan City, the IFEZ Authority, the Incheon Urban Development Corporation, and other public agencies; and various private developers and strategic partners. The PPCC provides a combination of services, but the main difference is that users pay the PPCC directly for elective services, rather than expect them to be delivered. Cisco hopes that this will make for both a more profitable and a more effective way of developing new technology around its S+CC projects. At the same time, in the case of Songdo, the municipal government of Incheon hopes to use the partnership to more effectively finance the services it provides.

In either case, both Cisco and IFEZ are 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. Songdo is, thus, a parody of the fantastical perpetual motion machine of the nineteenth century: a system that theoretically continues to produce wealth-without-end through the construction of huge conduits for bandwidth and of vast quantities of environmental sensors, all focused on the monitoring and indexing of its inhabitants' online and off-line behaviors. These self-referential and self-

Figure 8 Many "smart poles" are distributed throughout the city to collect and transmit data. Individually, their influence and "intelligence" is limited. However, once networked, their collective information contributes to a certain kind of distributed awareness. (Image: Cisco 2012a: 15)

Figure 9 Smart pole detail. (Image: Nerea Calvillo)

generating properties make Songdo, perhaps unsurprisingly, mimetic of the logics of the very financial systems that have conceived and sponsored this "product."

None of the individual elements that constitute this sensing and data-recording system are themselves possessed of any intelligence. They are inert devices designed to absorb input and direct it to a processing center that aggregates it and analyzes it. Sensing devices will be ubiquitous features of the city and will be active in both domestic and public spheres. For the latter, Songdo will use an integrated sensing element called a "smart pole" that provides light, sound, and navigation information. It is also equipped with a closed-circuit television camera and emergency broadcasting hardware (Cisco 2012a: 15). The smart pole can also receive input either through a call box with an emergency button or through an Internet terminal. These poles will be installed at regular intervals throughout the city and will be capable of both responding to and producing a range of environmental conditions. The input collected by any given smart pole is directed to the "integrated operating center" (IOC) that, in turn, analyzes the data and sends back commands to the source.

Figure 10 Demonstration control room, Tomorrow City, Songdo. (Image: Jesse LeCavalier)

Figure 11 The control rooms of the IOC would be staffed by monitors charged with watching over an array of screens and interfaces. Much of the management tasks will be automated, but the control rooms still require human oversight. (Image: Cisco 2012a: 18)

A control room is one of the dominant features of an IOC and is an interface that conveys to human monitors whatever the digitized urban environment unveils. As such, its power is feeble, its knowledge limited, and its vision blurred. Moreover, though it is prepared to handle emergencies and is clad in the aesthetics of Cold War preparedness, the control room is primarily a site of maintenance. Thus the monitors' role is one of management and not necessarily one of protection. Monitors survey the changing array of images in search of any perceived disruptions to the system.

In some cases, human monitors bear witness to events unfolding within a camera's cone of vision, but, more often, the large number of recording devices makes keeping track of all these data impossible. Thus the task of extracting relevant information is increasingly handled automatically. The often-used but still revealing phrase *data mining* reinforces the implicit understanding of these practices. Songdo's sensors act as a fleet of interconnected agents that track the behavior of human and nonhuman inhabitants of the city, turn their recorded activities

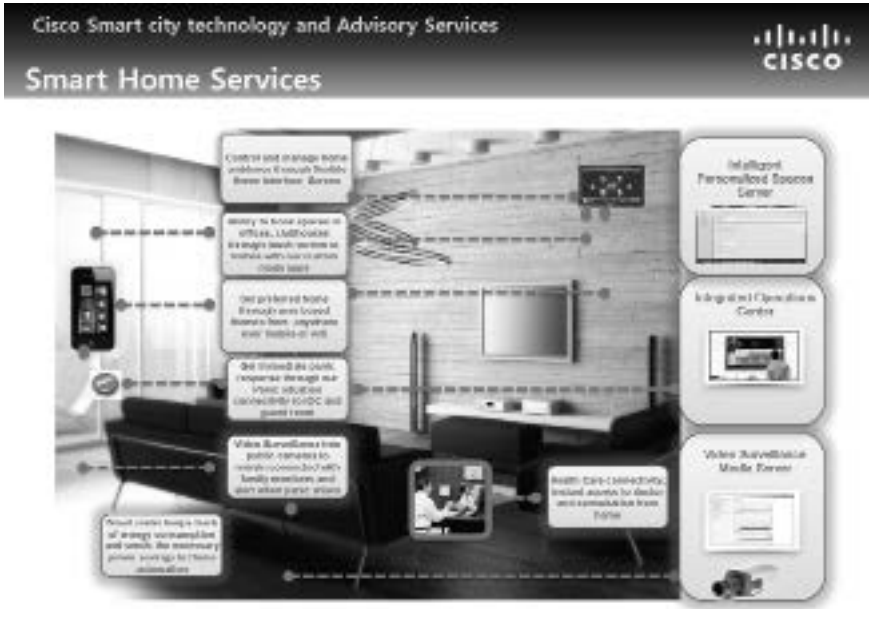

Figure 12 The ubiquity of screens reaches into the domestic sphere as well. While the interfaces remain at the level of object-screens, the aspiration is for less noticeable interfaces. (Image: Cisco 2012a: 10)

into data to be "mined," and eventually extract profitable information from this ethereal ore (Lohr 2012). While these sensors react individually to the information they retrieve from their limited environmental purview, the collective field they eventually produce becomes a layer of data that covers the city. According to Cisco's Tony Kim, the Korean government has made over 120 data sets available to private companies in an effort to stimulate economic growth. While this provided a number of opportunities, it also presents challenges in terms of how to archive those data, how to access them, and how to interface with them (T. Kim, pers. comm.).

At the domestic level, it is assumed that every wall, every mirror, and every surface can become an interface that offers users everything from on-demand data and weather reports to home medical monitoring.[5] But just what do we see

5. The current legal system in Songdo is being lobbied to enact changes in privacy laws that would allow the transfer of medical data outside of the hospital in order for Cisco to roll out its medical telepresences services. Demonstration videos show domestic spaces fitted out with home genetic testing kits, blood-work labs, and heart monitoring stations, all to insure the health of the residents of these luxury high-rises.

when we look at this universe of doubly communicative surfaces (in that they both send and receive)? In the promotional material from Songdo, these screens are interfaces that help viewers make better decisions to save time, money, energy, or anguish. Through this promise of omniscience and omnipresence viewers/users/consumers can exceed their human limitations thanks to the automated collection and analysis of data that are suddenly easy to access. But these interfaces work *on* us as much as *for* us. The bilateralism of the interface informs users but also makes them *informers*. That is, it works to optimize viewers and the network in which they operate. Because their habits and desires create a map of future habits, supply and demand will eventually merge.

In the meantime, the monetization of human attention continues as companies like Cisco intensify their research into ways to deploy and capture information. The limiting factor in increasing rates of data transmission is the capacity of the hardware and of the network to transmit information. 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. In fact, it is data, as a conceptual entity, that drive the ambitions of the city.[6] The dream of data ubiquity described by William Mitchell in 1996 and still present reinforces the concept of extendable value that emerges through the logic of constantly testing new functions, new products, and new applications. Songdo is driven by a fantasy that by translating everything into data the whole city could be managed as if it were a continuous and apprehensible system.

Figure 13 Sensor data can occasionally reach conclusions that are self-evident. (Image: Nerea Calvillo)

In this desire to "data-fy" the environment through the extreme expansion of bandwidth, any inhabitant, human or nonhuman, is considered measurable in different ways and all inhabitants are treated as equal entities in terms of the data they can provide. For example, the movement of people in the

6. Here it is useful to contemplate what form of data we are discussing. When we talk about data, we borrow Rob Kitchin and Martin Dodge's (2011: 5) distinction between data and "capta": with respect to a person, data are everything that is possible to know about a person, and capta are what is selectively captured through measurement."

city, the water velocity in a sewer, personal energy consumption, shopping habits, browsing patterns, or particulate matter suspended in the atmosphere, to name just a few, all feasibly contribute to the construction of a more responsive urban environment (T. Kim, pers. comm.). Because of the multiple but equally valid sources for these data, it no longer makes sense to address them in terms of qualitative or quantitative, subjective or objective. Rather, their definition is no longer about truth to nature or to an external world but is expanded to incorporate the emotional, the affective, and what was previously nonformal knowledge. Even the traces of transactions known as "shadow data," including phone conversations, credit cards, or movements through the city, are stored and made ready to be recycled for other purposes. However, if until now the choices made about what to collect and why have had histories of controversy and resistance, in the test-bed city the attitude is to collect indiscriminately and to accumulate by default.

The law of probabilities governs Songdo, and thus its mining of past data is done in the name of the future. While those responsible for the development of Songdo need *users* before they can manipulate user data, they are nonetheless proceeding with the implementation of the necessary sensing apparatus, even if its ultimate end use remains unclear. However, even if the precise future of the data cannot be predicted, it will most certainly be analyzed and cross-referenced automatically. The promise of such number crunching is that we will learn previously unknown things about ourselves based on an idea that the collective behavior of a city can be compiled and analyzed by machines to reveal profound trends in our social behavior. Yet this approach could also easily, and perhaps dangerously, produce a number of false correlations (Spade 2011). A likely outcome of these urban-scale calculations is a modification of concepts of normality. Rather than measure similarities in terms of their deviation from an established norm, producing what Ian Hacking (1990) calls "the taming of chance," or by an overlap of different normal curves producing "an interplay of differential normalities" (Amoore 2009: 55), the prediction models in the test-bed city are nonnormative. Instead, "normality" is constantly constituted as it emerges from the summated actions of daily life.

This is not to say that all reference points are removed, only that normative conditions index performance rather than ideal forms. Consider the actual production of the territory of Songdo as an example. In ideal cities of the past — a lineage in which we can place Songdo — city makers were preoccupied with the pursuit of perfect geometric conditions (Rosenau 1983: 55). The form of Songdo, by contrast, is conditioned by performance requirements and materializes the countless and competing protocols to which the city must submit in pursuit of global

Figure 14 Songdo is constructed by dredging sand from the ocean flow and consolidating it to create a new landform. (Image: Jesse LeCavalier)

competitiveness (Easterling 2004). Such requirements include things like channel depth for container ships, demographic analysis that predicts housing demand, or communications connectivity. So while Songdo is an accommodating vessel, it is a vessel nonetheless, a medium through which other media pass, including the increasingly datafied modules of international logistics systems. Even the city's national affiliations are hollowed out in pursuit of performance. Repeatedly, government officials and corporate sponsors insisted that the three IFEZ settlements would mediate between otherwise hostile neighbors China and Japan and that economics might eventually lead to reestablishing rail links through North Korea (Dr. Donyun Kim, pers. comm., July 3, 2012). This media convergence is a logic that extends to the production of the *actual* artificial land upon which this urban space rests. The idea of a protocol-driven — or algorithmic — expansion of space can expand beyond computational infrastructure to encompass the very logic by which territory, liquid and informational, comes into being. Freed from the model of an ideal form, the city can be enhanced without limit.

The Test-Bed Is an Epistemology

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. The technologies tested in Songdo are beta versions for similar systems put in place by many cities and rolled out regularly by high-tech and telecommunication corporations to service the now naturalized faith that human beings require ever-more information and bandwidth for social life. If many technologists and planners view these massive greenfield spatial products as banal and uninspired, it is at the cost of failing to realize that the array

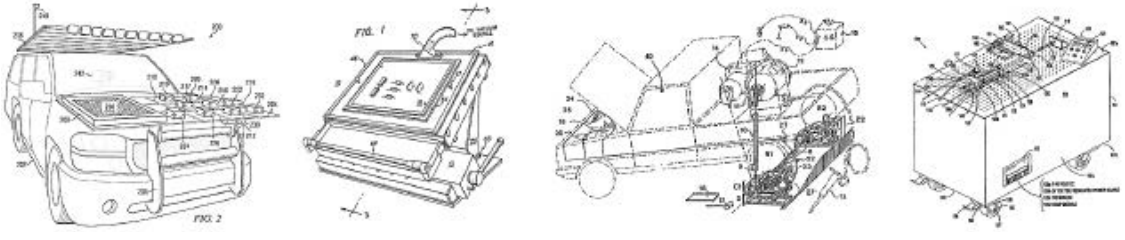

Figure 15 Patent illustrations of various test beds (left to right): Test Bed for In-Situ Studies; Universal Test Fixture Employing Interchangeable Wired Personalizers; Motion or Force Take-off Device for Motor Vehicles; Portable Electro-Hydraulic Test Bed Apparatus with Analog Control Station and Methodology

of conduits and cell phone towers of IFEZ are practice spaces for corporations to perfect the design of data collection and management infrastructures for any network — urban or otherwise.

If this is true, then what type of territory is Songdo? What can these test beds for urban construction help us see about this broader logic of testing and big data as forms of governmentality — those techniques of measurement, regulation, and monitoring — that organize space and manage life (Foucault 2009)? What types of knowing and acting are facilitated by way of test beds, and what makes them specific to our contemporary condition?

The Test Bed Is an Engine Not an Image

A "test bed" is not an experiment as conventionally conceived in ideals of science. The term does not denote the unearthing of a truth about the world. The phrase *test bed* emerges in the engineering literature to describe a controlled and often isolated development environment in which to test the operability of new technologies, processes, or theories for large systems. Test beds can include practices such as beta-testing software, testing control systems in manufacturing, stress testing in financial regulation, and so forth. In keeping with the logic of the present, Songdo is a test bed for a form of urban life that is itself the product — much

like the financial instruments that Donald A. MacKenzie (2006) describes as "engines, not cameras" as he argues that financial equations produced to model markets also produce markets in the equations' very circulation. The same is true here. This city is an engine for urban growth even as it purportedly tests the capacities of its own infrastructure. In essence, it is an experiment that cannot end, because every limit becomes a new engineering challenge, a new frontier to develop toward an ever-extendable horizon.

This extension relies on a certain refusal of intelligence, objectivity, and representation. Like the swarms, insect colonies, and chaotic systems that today are the sources of inspiration for computer scientists in producing technology and network architecture, Songdo is also built from a constant logic of dumbness, dispersal, and speculation. Self-organization is its dominant rationality. There is no image, because this form of "smartness" is not imagined as conscious, liberal, or objective. Rather, intelligence here is linked to performativity. Across the computational sciences, ideas of intelligence have ceased to be about linguistics or representation and turned instead to building smart systems from the complex interactions of many basic actions (Terranova 2004: 36–37). In Songdo, what is imagined is a generalized smartness that emerges from the sensor networks distributed all over the "body" of the city. No single sensor has the full picture of the environment, but as a collective they are able to act as if they did. If challenged, sensors can regroup as a network of statistical agents, each can react to the information it is provided with, and each can adjust its actions accordingly. This capacity for ubiquitous sensing is instrumental to a new manner of relating to the environment and, in these new cities, materializes in an architecture of sensing devices, communications towers, and fiber optic cables embedded throughout the built space.

More importantly, this approach to environment, planning, citizens, subjects, and intelligence marks a turn against the faith in liberal subjectivity, denigrates the place of older political processes in decision making over infrastructure as a site of activity, and operates at a level far beneath consciousness. This is a dream of a world that operates through networked nerves that hook the sentiments, feelings, and movements of live bodies into larger circuits of capital and technology, without (at least in the aspirations of the engineers) passing through the filter of representation. In the test bed the contours of the city are never stable, always modifiable, and the territory is extendable. The engineers are almost dismissive of the form of the city as it is envisioned as a self-governing entity. As such, unlike other utopias, the habitable form of the city and its machine function are neither ideal nor closely linked. This is both a blessing and a curse. Without ideal or

aspirational images, the future becomes blurry, but it also can become more open and extendable. The loss of centered subjects, the proliferation of surveillance and sensing, also comes with the decentralization of control and the proliferation of sites of action.[7]

The Test Bed Calculates Uncertainty Not Risk

This lack of ideal is not therefore merely the concern of connoisseurs of form. Rather, it is the mark of a method for speculation. This utopia of the version founds itself on a particular statistical and probabilistic logic based in feedback. Here the distinction Arjun Appadurai makes between risk and uncertainty might be useful. For planners there is a great deal of uncertainty in the outcomes of their experiments, but what has increased is a faith in "*techniques of calculability*" (Appadurai 2011: 528). This faith, and it takes mystical and magical undertones, embeds itself in the sensory environments and business models that largely bank on fantasized data sets that can be used to direct every aspect of life — from the medical status of bodies to education to entertainment.

These data are considered valuable because of an armament of new techniques for excavating results without ever knowing the objective endpoint or baseline. The language of ubiquity as the definition of smartness is revelatory in this case. Its lack of a definite endpoint or image of the city is indicative of the new calculations that take into account uncertainty but cannot think from within their internal logic about absolute failure, loss, or termination — if only because there is no base point from which to start. Repeatedly, both government officials and engineers argued that this was a prototype whose failings would be fodder for the next generation of city.

If something is being tested at Songdo, it is the question of how information technologies can determine the conditions of modern urban life. As Chris Dedicoat, the president for European Markets at Cisco, formulates, "The foundation for the city of the future will be the network and the information it carries" (quoted in Cisco 2011a). Thus test-bed urbanism is fundamentally a study into the possible ways modern digital technologies change the way we *will* inhabit our cities and the means by which these technologies *will* change our perception and experience of urban reality. It is a study of the future. This future, however, is always a mirror of the past. Test beds evaluate their own self-referential operations to speculate on a future time.

7. One might think of the movements — Anonymous, for example — operating on the very internal logics of this situation (Coleman 2012).

The capacity to envision such architectures of speculation and computability emerges with global transformations in attitudes to networks and computation. These transformations include a shift from a deterministic to a probabilistic mode of thinking in artificial intelligence, communication theories, social sciences, and economics, beginning after the Second World War and a concomitant interest in rethinking intelligence or "smartness" as distributed, performative and not representative or conscious.[8] If digital infrastructures determine the city of the future, then their characteristics will have a hidden, largely imperceptible, but highly formative influence on the way we live, and more importantly *will* live, our urban lives.

Songdo is, therefore, an enormous gamble for both urbanists and its developers. It is, in fact, the largest private real-estate project on earth (Arthur 2012). To understand how such capacities to make such investments occur, it is important to understand how Songdo is one material manifestation of a far broader faith in new forms of statistical calculation to mitigate and disperse risks into a new term, *uncertainty*. It is helpful to recall that the analysis of big data sets bases itself in methods such as Bayesian filtering and statistics. What marks these methods is that they deal with quantities that cannot be discretely measured or stably represented, which is to say that they lack an "image" in our parlance. Frank Knight in the early 1920s, in a critical treatise on economics articulated this distinction:[9]

> But Uncertainty must be taken in a sense radically distinct from the familiar notion of Risk, from which it has never been properly separated. The term "risk," as loosely used in everyday speech and in economic discussion, really covers two things which, functionally at least, in their causal relations to the phenomena of economic organization, are categorically different. . . . The essential fact is that "risk" means in some cases a quantity susceptible of measurement, while at other times it is something distinctly not of this character; and there are far-reaching and crucial differences in the bearings of the phenomenon depending on which of the two is really present and operating. There are other ambiguities in the term "risk" as well, which will be pointed out; but this is the most important. It will appear that a *measurable* uncertainty, or "risk" proper, as we shall use the term, is so far different from an *unmeasurable* one that

8. For work on time, epistemology, and the nature of probability in digital media, see Halpern 2005.

9. Despite being written in 1921, Knight's work takes prominence only after World War II with the rise of Chicago school economics and neoclassical economics. Milton Friedman, for example, was a student of Knight's.

> it is not in effect an uncertainty at all. We shall accordingly restrict the term "uncertainty" to cases of the non-quantitative type. It is this "true" uncertainty, and not risk, as has been argued, which forms the basis of a valid theory of profit and accounts for the divergence between actual and theoretical competition. (1921, pt. 1, chap. 1, 26)

Bayesian inference is one example of numerous methods deployed to operate on precisely such unmeasurable, subjective, and qualitative endpoints. Such methods mark a turn to inductive reasoning, subjective perspective (there are no stable truth claims), and the abandonment of stable baselines or norms, a turn that finds itself incarnated in such ideas as "data-driven" science, marketing, and strategy. To be data driven is to start without ideal or hypothesis, to assume no stable baselines, and to always modify your conclusion. Risk is replaced with constant testing and versioning.

This loss of risk is closely linked to the problems that these methods address. One of the basic issues in the computational analysis of data — sensory or otherwise — is that most problems in the world cannot be algorithmically or logically represented. Uncertainty is much more likely in our world than risk is. Ubiquitous computing aspires to manage uncertainty, not risk. The hurdle is that computation is linked mostly to risk — to measurable, quantitative, rational qualities. In the logic of Boolean operators that underpins most programming and algorithms, the world is represented as either-or and can be explored by if-then statements, for example, "If you find that A, then it is definitely the case that B." The world, however, is full of complex, difficult, and strange behaviors that are not causal in this matter.

By contrast, the test-bed world of big data fields is a probabilistic one where few things are certain and most are only probable. Test beds are defined by methods like Bayesian inference, where "Even if we know that A, we cannot be certain that B. And if for a time we strongly believe that B, we may later learn new evidence, which convinces us of the opposite." The Boolean world is deterministic; in principle everything is predictable if all relevant knowledge is available. The test-bed world is statistical. The analytic methods of big data, including Bayesian statistics, surmount this qualitative/quantitative divide, however, by never defining the problem or hypothesis ahead of time. The new modes of calculation deploy technologies that are algorithmic and Boolean in manners that support the management of nonmeasurable and indeterminate outcomes. Developers, financiers, management, and high-tech companies all work inductively, simply from the behavior of the system rather than from deductive theories that must be tested. What is less clear is what the conditions and limits are for what can be sensed and assimilated.

If past utopias described a dreamworld of empirical study and deductive reason, an emerging utopian dream is to bridge a world of discrete things — objects, algorithms, logic definitions — with a world of free-flowing infinity. The Gothic cathedral and the spatial dream of infinity will come into the network and will cover the globe and beyond. So infinite is this dream that we can no longer even visualize it. The loss of the ideal image of space is replaced with an ideal of the perfect methodology.[10]

This is the law of the test bed. In the world of the test bed there must always be more data, and there is never a stable endpoint. Time itself is broken. There are no events in the test bed. Disasters, like accidents, ecological degradation, and medical emergencies, are regularly detailed but are not terminal or measurable events. Instead, they are an ongoing process that can be manipulated and managed through constant feedback. This is a city built to anticipate the uncertain and to accommodate it through the decentralized nature of networked infrastructure that has itself automated emergence and change as regular and manageable processes. Disorder, catastrophe, and chaos are managed, not because they can be represented and apprehended, but because the test bed is about methods of calculation that do not demand clear definition.

The test bed thus transforms time, change, and events into uncertainties and trials. This is a new form of administration that lacks norms, frequency distributions, and the statistical apparatus of older demographic, state, and economic thinking in the name of a new epistemology of infinity, nonnormativity, and speculation. While this is potentially liberating, the loss of norms also undermines moral grounds for action. Political decision making is constantly deferred and managed technocratically. But these instabilities and emergences also produce strange actions in the network with often surprising results. As critiques of modernity have long noted, the concept of a rational, measurable endpoint — utopia — has led to catastrophe. Having lost this vision of the ideal city, we must learn to embrace the manipulation of probabilities without idealizing the concept of emergence. History and politics need to be rethought in terms of probabilities, densities, distributions, and performances.

The Test Bed Is about Populations and Territories, Not Individuals in Space

We opened this essay with *New Atlantis*, a historical reference important to historians of science and politics. Bacon illuminates, at the start of the scientific and

10. For further background on histories of governance, statistical reasoning, and calculation, see, for example, Daston 1988, Gigerenzer 1989, and Hacking 1990.

political revolutions of the seventeenth century, a transformation in the ways that society might be governed. According to Michel Foucault, Bacon made visible the historical emergence of an idea that the terms *reason*, *rationality*, and *ratio* are fundamentally linked. For Foucault (2009: 277), only in the late sixteenth and the seventeenth centuries did the discovery of ideal laws of nature (ratios) get linked to the reason of government. This correlation between knowledge and power transformed space as well. The state is not just the area administered by a sovereign but a space that has qualities that can be measured, rationalized, and experimented on. Space became *territory*, an area defined not merely by physical geography but by ratios. Thus territory is not an area governed by a sovereign but an area concerned with the security (the sustainability, maintenance, and qualities) of a population. As geographer Stuart Elden states, "Just as the people become understood as both discrete individuals and their aggregated whole, the land they inhabit is also something that is understood in terms of its geometric, rational properties, or 'qualities' " (2007: 578). This is another way of saying that the modes of discovering the rules or "ratios" that govern a space become the role of government. This is about not just counting but speculating: statistics and geometry are linked in seeking to unearth recurring patterns that are scalable in time and space and can allow speculation on the future forms of the population, their actions, and the shape of the space they will occupy.[11]

What marks the new territories of ubiquitous computing and test-bed experiments is that these "qualities" can be redistributed and partitioned with growing plasticity, and their populations comprise not individual bodies but literal partitions of attention and nervous energy that can be grouped into different "wholes" that are unstable, and like the territories they occupy, mobilized, circulated, and speculated upon.

In this newest state of government the population and the territory have become the same — which is to say that the territory being sold is based on the attentive consumption and the monitoring of that consumption by groups of individuals. These individuals can be anywhere in the world; the territory is plastic — it comprises all those who download medical assistance, yoga lessons, or language courses, for example. It also comprises all the other spaces where similar infrastructures are being laid down or where cities are built on the premise of ubiquitous data wealth. Songdo therefore is an experiment in administration, territory production, and finance.

11. For another in-depth discussion of how numeracy, measurement, and logistics are transforming territories see, e.g., LeCavalier 2010.

Songdo is testing not which kind of data are measured or manipulated but *how* they can be managed so that the whole process can be exported elsewhere. This is the territory of management and algorithmic processes. All the agents — individually and as teams — are packaging their knowledge, expertise, and services, so they can sell it to other cities.[12] It is this exportability that matters in the test bed, for that is what can be implemented in future phases of development. But this model presents Cisco, once again, with the fundamental problem of the lack of compatibility or common formats that can ensure the easy exchange of data. For this reason the Korean government, in partnership with Cisco, is now leading an international project that tries to develop the protocols of the smart city, having the Internet protocols as a reference, by which data can be exported, recombined, homogenized, and linked. In the territories built for and by this world — envisioned as data rich but resource constrained — this apparent incommensurability between territories, spaces, mediums, and futures has been transformed from limits to thresholds. If, for example, in the Cold War, there appeared to be a final boundary, a terminal imaginary of total destruction or an absolute limit to natural resources, then in the contemporary territories of digital machinery, these normative constraints have become flexible spaces for eternal expansion in the name of perfectibility-without-end through technological manipulation.[13] The turn to uncertainty over risk finds itself embodied in this type of territorial form and redistribution of population.

Figure 16 A view from Songdo's Central Park (Image: Drit Halpern)

Wishing/Testing

Even as this place is marked as the future, it already looks obsolete. In Songdo, even the buildings shoulder this temporal fold, forced to accelerate to the future and built at speeds virtually unthinkable in North America. For example, in an interview at SK Telecom, one of South Korea's premier wireless service providers, the chief technology officer

12. For example, Cisco will be importing the entire master plan of Songdo to Guayaquil, Ecuador, thus literalizing the idea of an exportable city.

13. We view nuclear preparedness and biopolitics as part of the history of these forms of development but also as radically different from the logic of the test bed, especially in terms of uncertainty and calculation. For writing that has a different perspective on preparedness and managing life, see Lakoff 2006 and Agamben 2001.

for ubiquitous city projects proudly boasted of setting up ubiquitous computing developments housing 1.2 million people within five years (Tae 2012). Songdo currently has thirty thousand inhabitants but projects a population of three hundred thousand within five years. In anticipation, eager construction companies have built dozens of speculative residential towers since Songdo's inception, but already they are showing signs of wear, as if their speed has aged them prematurely. Even the promised armory of high bandwidth video feeds, ubiquitous computational capacity, ambient environmental monitoring, and biofeedback control remain inoperable.

Examining cities that are built out of nothing affords a direct, if uncomfortable, confrontation with some of the assumptions about what cities are, or at least what they are thought to be. More disquieting, we must contemplate our dream-images of the future.

Looking at this seeming simultaneous wasteland and wild frontier of digital speculation, we see vast towers built as some parody of Le Corbusier's "City of Tomorrow." We should ask ourselves why — if the infrastructure could generate any form — we are so limited by older imaginaries of vision and structure. "Space," writes Tiziana Terranova, "does not really need computers to be informational even as computers make us aware of the informational dimension. . . . An informational space is inherently immersive, excessive and dynamic: one cannot simply observe it, but becomes almost unwittingly overpowered by it" (2004: 37). As Ash Amin writes on the logics of urban forms, since the urban unconscious is "composed of a city's material infrastructure as well as a city's 'aesthetics of surfaces and quantities,' it can be thought of as a field of affective excess that is able to 'hypnotize, overexcite or paralyze the senses' " (Amin 2010: 6). These accounts describe a situation in which, like early experiments in utopian form, urban inhabitants wish for a total vision of the environment, rather than embrace our machinic attributes and, what Donna Haraway (1988: 575) calls, a "partial perspective." What all these theorists gesture toward is our inability to understand the networks in which we are enmeshed. We should not be so sure of the present and pass verdict on our networks. For if the return to modernist utopian visions in planning seems horrible, no less horrid is a nostalgic lament for the beauty of human community before the time when machines, also, were bequeathed sentience. Our networks are often more lively than we can predict. If the test bed is our new epistemology, we should err toward the incalculability of uncertainty rather than the measurable logics of risk.

In returning to these older fantasies of objectivity and measure — from modernist utopias and computation — we threaten our own future. Perhaps this is the

problem: in the logic of the test bed, past data are always used to produce the future. But when prediction collapses into production, we lose any possibilities of emergence, of change, or of dynamic life. We often assume that we understand complex systems and our machines, even if we do not or cannot. Perhaps, then, we can embrace the epistemology of the test bed and begin to design with less authority and greater interest in the space of society and culture that is produced in the interstices between what is human, machine, and animal. Perhaps it is out of the magic of our humming networks and the complexity of our mute black boxes that new ideas about design will emerge.

Even as we write, the ontology of cities is changing rapidly and dramatically. Old categories that have served well for centuries are becoming obsolete, like urban versus rural, infrastructure versus built visible structures, home versus work. The topographies, the spatiotemporal relations among citizens and with respect to the places they inhabit, undergo profound changes as well. Distances diminish as the costs and speed of transferring goods and information decrease; shapes are becoming skewed as proportionalities change. And the various layers of city networks — the material and digital skeletons of the city — extend, branch, and interweave, causing traditional boundaries to vanish, whether between different infrastructures like information and energy, between the serving and the served, or between citizen and city.

The new ontologies that arise are digital and algorithmic; they are often elusively abstract, like data densities, clouds, statistical risks, or visibilities, and sometimes oppressively concrete, like ubiquitous cameras, secretive control rooms, or windowless data centers serving the needs of the machines. Novel actors populate newly emerging city spaces, displacing older inhabitants of the cityscape. The data center ousts the office space, cameras the watchman, sensors the maintenance technician, and so forth. The city ceases to be modular, with unforeseen consequences regarding emergencies and control. Data is the main category that drives the transformation of modern city life and rearranges the hierarchies and connections of objects and people.

The impact of these changes is still felt mostly around the edges of our most massive urban spaces, in places like the peripheries of rampant greenfield cities in China or India that need to accommodate an ever-increasing influx of people. Or serve as the latest gated communities. Or in nonspaces, in context-free and replicable environments, like the case study of Songdo, which seems to be more a product of global corporate culture than of the Korean context into which it is implanted. But projects like Songdo are just test beds for the larger revolution of urban life that will increasingly infiltrate even the most settled of urban environ-

ments. Such test-bed urbanism accompanies the digital revolution of an urban life trying to assess the impact of the algorithmic on tomorrow's citizens. Never before in history have cities been subjected in such scale to the technocratic visions and trials of a few anonymized global companies. But never before have there also been so many new agents and agencies — human, machine, and other — networked in new arrangements and intelligences. These experiments will concern us long before their outcome will be clear. But like the many speculators and corporations trying to bank in on these developments, only to be frustrated in their financial ambitions, the present is rather cloudy and the future often unpredictable.

Methodological Appendix: Milgram Reloaded

The Milgram Group
(Nerea Calvillo, Orit Halpern, Jesse LeCavalier, and Wolfgang Pietsch)

Few experiments incite such sentiment, anger, and moral and ethical concern like those of psychologist Stanley Milgram from the early 1960s. He terrifyingly demonstrated that people do irrational and even terrible things when asked to follow the rules. In performing these classic experiments, full of actors, stage props, and unknowing participants, he created a mirror, another world, an altered reality, that could show us what we could not perhaps see on our own.

We open with this citation to the most famous of social science experiments, because as a collective we seek both to extend and to contest such methods of social research. Milgram's troubling experiments were part of a broader transformation in the social and human sciences that increasingly treated the world as a laboratory and experiments as performative enactments. From cybernetic robots and rats to simulations of disasters and nuclear wars, the image of the world, its enactment and reality, became a blurry place that transgressed the possible, the probable, the fantastical, and the real, producing new realities, making new features of the social world visible, and simultaneously obscuring and denying many other features.

Today we live in the legacy of these systems. Standing on the shores of vast digital realms, massive data worlds built by corporations like Google or enormous greenfield developments like Songdo, South Korea, we are forced to ask about the relationship between experiments and reality, to ask about what types of inquiry the social sciences can develop to address these self-enclosed and autopoietic worlds. Where is the observer situated? What are the boundaries of the laboratory? Where does the world start and end? What sort of actions can create mirrors

that produce different realities and help us address ongoing ethical, moral, and political inequalities while generating new images of the world? Perhaps we are even forced to ask what would constitute moral and ethical evaluation in a world of smart machines and seemingly stupid spaces.

In many of his experiments, Milgram exposed people to unexpected situations, leaving them to deal with a social environment they did not really understand. The conditions of our own collaborative work as part of Poiesis also contain elements of such experimentation, about alternative ways by which to organize science, how research can be radically open, radically interdisciplinary, radically intercultural, and radically democratic. Lock a small number of goodwilled people in a room — and ask them to undertake a scientific project. This was our situation: four persons, four academic careers, four styles of thinking, four scientific cultures.

As a group we seek forms of action, enactment, and subjective observation, trying to gain new ways of looking and developing different sensibilities (Hinchliffe et al. 2003) that could produce new images, descriptions, and imaginaries of the banal, technical, and sometimes overdetermined. The systems we use every day, the interfaces we play with, the labyrinth and anonymous architectures of data centers, and the massive spatial products of global developers and high-technology corporations are the sites of our inquiry, interest, and interaction.

Our main concern therefore is to unearth novel phenomena at the intersection between society and modern information technologies. In many ways, the approach is zoological; it is about naming and classifying. We are looking for digital beasts, screening the digital world for unknown creatures to observe, to catch, to categorize, and to dissect. While many believe that the only frontier for today's scientific adventurer is outer space, technological advances are constantly opening up wild and unexplored spaces in our immediate vicinity. At first, these are determined only by the ever-extending boundaries of the technologically possible, inhabited only by technological experts, who know well how to survive and to profit but who are often unaware of the larger context in which we are interested. Ours is the endeavor to look at the interrelations between the digital species and their habitat, the digital ecosystems.

Much of our work concerns naming and renaming, collecting and classifying, a memetic tracing of ideas. At the beginning stands the Baconian task to encounter the digital in as many environments as possible, as Bacon once urged that research should start with a collection of "instances which agree in the same nature, though in substances the most unlike" — a collection to be made "in the manner of a history, without premature speculation, or any great amount of subtlety" (Bacon 1996: 127). That is why we engaged in a number of case studies, why we became

interested in Google's algorithms, in large data storages in midtown Manhattan, and in sensing lampposts in the greenfield city of Songdo.

For us, the naming and classification is essentially a creative process, a poetic undertaking. As in a poem, suitable terms can provide novel viewpoints and new insights into the digital world. We would try out analogies, often far-fetched, between the phenomena we encountered and other fields more or less familiar to us from our own work. For example, we looked into the analogy between the digital world and medieval bestiaries, highly elaborate and lavishly illustrated compendia of exotic and sometimes mythical animals. We also explored at length the analogy between scientific experimentation and the way digital technologies are installed into urban environments.

It is in these creative moments, whether they concern the search for ideas, the elaboration of our research method, or the invention of new terms, that our interdisciplinary background plays out the strongest. In a disciplinary context we would often have gone with the first option that came to mind. On the one hand, interdisciplinarity forces us to rethink, to constantly widen our discussions, to resist the urge to go with the easiest choice, to try to change perspective, or to view the issues from a metalevel. On the other hand, in the formulation of results, interdisciplinarity proves to be a considerable obstacle. It proves enormously challenging to sketch one coherent picture that we can all identify with.

In several ways, naming the digital is unlike other tasks of nomenclature in the sciences. In typical examples, like the classification of species in biology, of elements in chemistry, or of crystals in the theory of solids, there appears to be an underlying ontology of natural kinds, which more or less fixes the classification scheme. There is little leeway in how chemical elements are to be grouped, hence the structure of the periodic table. The task of these special sciences then is simply to discover the classification schemes. By contrast, there is no determined underlying ontology of the digital world, in particular when it comes to the relation with the social. Rather, it must be invented, involving a creative and poetic element. It must be pluralistic, a side-by-side of different, complementary perspectives. An invented terminology cannot be, in a strict sense, right or wrong. The criteria are whether it resonates with experience, whether it manages to link up a number of seemingly unrelated phenomena, whether it turns out useful in an eventual coming to terms with the digital world.

Revolutions of various kinds generally imply a language change, and, conversely, language changes sometimes trigger revolutions. The French Revolution required a new vocabulary to account for its emerging democratic institutions.

The Darwinian revolution fundamentally changed the way people think and talk about species, as the rigid boundaries between species were dissolved and new classification schemes emerged that were based on evolutionary development. The digital revolution is not much different. It is not only producing a new range of phenomena that need to be classified and named; it is also changing the long-standing ontology of the social world. Those often unrecognized shifts are what interest us most. For instance, the change in network structure of our social interactions induced by novel means of communication, such as the Internet, in turn transforms basic social concepts like the normal or the democratic.

We try to detect such novel phenomena at the interface between digital technology, the human, and the social, to propose terms for a language of the digital revolution. In the end, the nomenclature can only be a first step, if an essential one, on the way to a better understanding and control of digital phenomena. In the long run, the goal must be proactive, examining how an improved linguistic grasp and understanding of the digital can be used for improving the human condition.

References

Agamben, Giorgio. 2001. On security and terror. Translated by Soenke Zehle. *Frankfurter Allgemeine Zeitung*, September 20.

Amin, Ash. 2010. *Cities and the ethic of care for the stranger.* Joseph Rowntree Foundation/University of York Annual Lecture. Available at www.jrf.org.uk.sites/files/jrf/cities-and-the-stranger-summary.pdf.

Amin, Ash, and Patrick Cohendet. 2004. *Architectures of knowledge: Firms, capabilities, and communities*. New York: Oxford University Press. doi:10.1093/acprof:oso/9780199253326.001.0001.

Amoore, Louise. 2009. Algorithmic war: Everyday geographies of the war on terror. *Antipode* 41, no. 1: 49–69. doi:10.1111/j.1467-8330.2008.00655.x.

Appadurai, Arjun. 2011. The ghost in the financial machine. *Public Culture* 23, no. 3: 517–39.

Arthur, Charles. 2012. The thinking city. *BBC Focus*, no. 237: 55–58.

Augé, Marc. 1995. *Non-places: Introduction to an anthropology of supermodernity*. London: Verso.

Bacon, Francis. 1996. *Novum organum*. In *Collected works of Francis Bacon. Volume I, Part I, Philosophical work*. London: Routledge/Thoemmes Press.

Cisco. 2011a. Cisco collaborates with Barcelona to support "2020 Vision" for sustainable urban management and economic growth. News release, February

16. investor.cisco.com/common/mobile/iphone/releasedetail.cfm?ReleaseID=550585&CompanyID=CSCO&mobileid=#.

———. 2011b. Cisco Smart+Connected Communities: Media backgrounder. gov.ns.ca/govt/pubs/Cisco-SCC-Media-Backgrounder.pdf.

———. 2012a. Smart City Technology and Advisory Services. Powerpoint slide presentation by Tony Kim and Gui Nam Choi, July 4.

———. 2012b. Smart+Connected Communities: Public-private partnered model development in Korea IFEZ / Songdo. Powerpoint slide presentation by Tony Kim and Gui Nam Choi, July 4.

Coleman, Gabriella. 2012. Our weirdness is free: The logic of anonymous — online army, agent of chaos, and seeker of justice. *Triple Canopy*, no. 15. canopycanopy canopy.com/15/our_weirdness_is_free.

Cortese, Amy. 2007. An Asian hub in the making. *New York Times*, December 30. www.nytimes.com/2007/12/30/realestate/commercial/30sqft.html?pagewanted=all.

Crang, Mike, and Stephen Graham. 2007. "Sentient cities: Ambient intelligence and the politics of urban space." *Information Communication and Society* 10, no. 6: 789–817. doi:10.1080/13691180701750991.

Daston, Lorraine. 1988. *Classical probability in the Enlightenment*. Princeton, N.J.: Princeton University Press.

Easterling, Keller. 2004. The new orgman: Logistics as an organizing principle of contemporary cities. In *The cybercities reader*, edited by Stephen Graham, 179–84. London: Routledge.

Elden, Stuart. 2007. Governmentality, calculation, territory. *Environment and Planning D: Society and Space* 25, no. 3: 562–80.

Foucault, Michel. 1986. Of other spaces. *diacritics* 16, no. 1: 22–27.

———. 2009. *Security, territory, population: Lectures at the Collège de France, 1977–1978*. Edited by Michel Senellart and translated by Graham Burchell. New York: Picador.

Gigerenzer, Gerd, ed. 1989. *The Empire of chance : how probability changed science and everyday life*. Cambridge: Cambridge University Press.

Gordin, Michael D., Helen Tilley, and Gyan Prakash. 2010. Introduction: Utopia and dystopia beyond space and time. In *Utopia/dystopia: Conditions of historical possibility*, edited by Michael D. Gordin, Helen Tilley, and Gyan Prakash, 1–20. Princeton, N.J.: Princeton University Press.

Hacking, Ian. 1990. *The taming of chance*. Cambridge: Cambridge University Press.

Halpern, Orit. 2005. Dreams for our perceptual present: Temporality, storage, and interactivity in cybernetics. *Configurations* 13, no. 2: 283–319.

Haraway, Donna. 1988. Situated knowledges: The science question in feminism and the privilege of the partial perspective. *Feminist Studies* 14, no. 3: 575–99.

Hinchliffe, Steve, Matthew B. Kearnes, Monica Degen, and Sarah Whatmore. 2003. Urban wild things: A cosmopolitical experiment. *Environment and Planning D: Society and Space* 23, no. 5: 643–58.

Ho Lee, Sang, Jung Hoon Han, Yoon Taik Leem, and Tan Yigitcanlar. 2008. Towards ubiquitous city: Concept, planning, and experiences in the Republic of Korea. In *Knowledge-based urban development: Planning and applications in the information era*, edited by Tan Yigitcanlar, Koray Velibeyoglu, and Scott Baum, 148–69. Hershey, Penn.: Information Science Reference.

Hollands, Robert. 2008. "Will the real smart city please stand up?" *City* 12, no. 3: 303–20. doi:10.1080/13604810802479126.

IBM. 2012. Smarter planet: Let's build a smarter planet. www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet (accessed August 7).

Incheon Free Economic Zone Authority. 2011. *We Build Success* brochure.

Kasarda, John, and Greg Lindsay. 2011. *Aerotropolis: The way we'll live next*. New York: Farrar, Straus and Giroux.

Kitchin, Rob, and Martin Dodge. 2011. *Code/space: Software and everyday life*. Cambridge, Mass.: MIT Press.

Knight, Frank. 1921. *Risk, uncertainty, and profit*. Library of Economics and Liberty. www.econlib.org/library/Knight/knRUP1.html#Pt.I, Ch.I (accessed October 9, 2012).

Lakoff, Andrew. 2006. Preparing for the next emergency. Working paper, Laboratory for the Anthropology of the Contemporary, Berkeley, Calif.

LeCavalier, Jesse. 2010. All those numbers: Logistics, territory, and Walmart. *Places: Forum of Design for the Public Realm*, May 24. places.designobserver.com/feature/walmart-logistics/13598.

Lindsay, Greg. 2010. The new new urbanism. *Fast Company*, February, 88–95.

Living PlanIT. 2012. PlanIT Valley — the benchmark for future cities and sustainable urban communities. living-planit.com/planit_valley.htm.

Lohr, Steve. 2012. The age of big data. *New York Times*, February 11. www.nytimes.com/2012/02/12/sunday-review/big-datas-impact-in-the-world.html?pagewanted=all.

MacKenzie, Donald A. 2006. *An engine, not a camera: How financial models shape markets*. Cambridge, Mass.: MIT Press.

Mitchell, William. 1996. *City of bits*. Cambridge, Mass.: MIT Press.

Office for Metropolitan Architecture, Rem Koolhaas, and Bruce Mau. 1995. *S, M, L, XL*. New York: Monacelli.

Rosenau, Helen. 1983. *The ideal city: Its architectural evolution in Europe*. New York: Methuen.

Spade, Dean. 2011. *Normal life*. New York: South End.

Tae, kyoungIm. 2012. Author interview, South Korea, July 5.

Terranova, Tiziana. 2004. *Network culture: Politics for the information age*. London: Pluto.

Weiser, Mark. 1991. "The computer for the twenty-first century." *Scientific American* 265, no. 3: 94–104. doi:10.1038/scientificamerican0991-94.