THE SMARTNESS MANDATE

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INTRODUCTION

On November 6, 2008, still in the immediate aftermath of the worldwide economic crisis initiated by the US subprime mortgage market collapse, then-chairman of IBM Sam Palmisano delivered a speech at the Council on Foreign Relations in New York City. The council is one of the foremost think tanks in the United States, its membership composed of senior government officials, members of the intelligence community (including the CIA), business leaders, financiers, lawyers, and journalists. Yet Palmisano was not there to discuss the fate of the global economy. Rather, he introduced his corporation's vision of the future in a talk titled "A Smarter Planet." In glowing terms, Palmisano laid out a vision of fiber-optic cables, high-bandwidth infrastructure, seamless supply chain and logistical capacity, a clean environment, and eternal economic growth, all of which were to be the preconditions for a "smart" planet. IBM, he argued, would lead the globe to the next frontier, a network beyond social networks and mere Twitter chats. This future world would come into being through the integration of humans and machines into a seamless Internet of Things that would generate the data necessary for organizing production and labor, enhancing marketing, facilitating democracy and prosperity, and—perhaps most importantly—for enabling a mode of automated, and seemingly apolitical, decision-making that would guarantee the survival of the human species in the face of pressing environmental challenges. In Palmisano's talk, "smartness" referred to the interweaving of dynamic, emergent computational networks with the goal of producing a more resilient human species—that is, a species able to absorb and survive environmental, economic, and security crises by perpetually optimizing and adapting technologies.[1]

Palmisano's speech was notable less for its content, which to a large degree was an amalgamation of existing claims about increased bandwidth, complexity, and ecological salvation, than for the way in which its economic context and planetary terminology made explicit a hitherto tacit political promise that had attended the rise of smart technologies. Though IBM had capitalized for decades on terms associated with intelligence and thought—its earlier trademarked corporate slogan was "Think"—by 2008 the adjective "smart" was attached to many kinds of computer-mediated technologies and places, including phones, houses, cars, classrooms, bombs, chips, and cities. Palmisano's "smarter planet" tagline drew on these earlier invocations of smartness, especially the notion that smartness required an extended infrastructure that produced an environment able to automate many human processes and respond in real time to human choices. His speech also underscored that smartness demanded an ongoing penetration of computing into infrastructure to mediate daily perceptions of life. (Smartphones, for example, are part of a discourse in which the world is imagined as networked, interactive, and constantly accessible through technological interfaces, a smartphone's touch screen is in fact enabled by an infrastructure of satellite networks, server farms, and cellular towers, among many other structures that facilitate regular access to services, goods, and spatial location data.) But as Palmisano's speech made clear, these infrastructures now demanded an *infrastructural imaginary*—an orienting telos about what smartness is and does. This imaginary redefined no less than the relationships among technology, human sense perception, and cognition. With this extension of smartness to both the planet and the mind, what had been a corporate tagline became a governing project able to individuate a citizen and produce a global polity.

This new vision of smartness is inextricably tied to the language of crisis, whether the latter is a financial, ecological, or security event. But where others might see the growing precariousness of human populations as best countered by conscious planning and regulation, advocates of smartness instead see opportunities to decentralize agency and intelligence by distributing it among objects, networks, and life-forms. They predict that environmentally extended smartness will take the place of deliberative planning, allowing resilience in a perpetual transforming world. Palmisano proposed "infus[ing] intelligence into decision making" itself.[2] What Palmisano presented in 2008 as the mandate of a single corporation is in fact central to contemporary design and engineering thinking more generally.

We call these promises about computation, complexity, integration, ecology, and crisis *the smartness mandate*. We use this phrase to mark the fact that the assumptions and goals of smart technologies are widely accepted in global polity discussions and that they have encouraged the creation of novel infrastructures that organize environmental policy, energy policy, supply chains, the distribution of food and medicine, finance, and security policies. The smartness mandate draws on multiple and intersecting discourses, including ecology, evolutionary biology, computer science, and economics. Binding and bridging these discourses are technologies, instruments, apparatuses, processes, and architectures. These experimental networks of responsive machines, computer mainframes, political bodies, sensing devices, and spatial zones lend durable and material form to smartness, often allowing for its expansion and innovation with relative autonomy from its designers and champions.

This book critically illuminates some of the key ways in which the history and logic of the smartness mandate have become dynamically embedded in the objects and operations of everyday life—particularly the everyday lives of those living in the wealthier Global North but, for the advocates of smartness, ideally the lives of every inhabitant of the globe. This approach allows us to consider questions such as the following: What kinds of assumptions link the "predictive" product suggestions made to a global public by retailers such as Amazon or Netflix with the efforts of Korean urban-planning firms and Indian economic policy-makers to monitor and adapt in real time to the activities of their urban citizenry? What kinds of ambitions permit the migration of statistically based modeling techniques from relatively banal consumer applications to regional and transnational strategies of governance? How do smart technologies that enable socially networked applications for smartphones—for example, the Microsoft Teams app, which enables distributed multisite and multiuser conversation and workflow and is used by 75 million registered users a day (located primarily in the US, Europe, Latin America, and Asia)—also cultivate new forms of global labor and governmentality, the unity of which resides in the coordination via smart platforms rather than, for example, geographical proximity or class?[3] Each of these examples relies upon the mediation of networks and technologies that are designated to be smart, yet the impetus for innovation and the agents of this smartness often remain obscure.

We see what is still the relatively short history of smartness as a decisive moment in histories of reason and rationality. In their helpful account of what they call "Cold War rationality," Paul Erickson and his colleagues have argued that in the years following World War II, American science, politics, and industry witnessed "the expansion of the domain of rationality at the expense of . . . reason," as machinic systems and algorithmic procedures displaced judgment and discretion as ideals of governing rationally.[4] Yet at the dawn of the twenty-first century, Cold War rationality gave way to the tyranny of smartness, an eternally emergent program of real-time, short-term calculation that substitutes *demos* (i.e., provisional models) and simulations for those systems of artificial intelligence and professional expertise and calculation imagined by Cold War rationalists. In place of Cold War systems based on "rational" processes that could still fall under the control and surveillance of centralized authorities or states, the smartness mandate embraces the ideal of an infinite range of experimental existences, all based on real-time adaptive exchanges among users, environments, and machines. Neither reason nor rationality is understood as a necessary guide for these exchanges, for smartness is presented as a self-regulating process of *optimization* and *resilience* (terms that, as we note below, are themselves moving targets in a recursive system).

Whereas Cold War rationality was highly suspicious of innovation, the latter is part of the essence of smartness. In place of the self-stabilizing systems and homeostasis that were the orienting ideal of Cold War theorists, smartness assumes perpetual growth and unlimited turmoil; destruction, crisis, and the absence of architectonic order or rationality are the conditions for the possibility for smart growth and optimization. Equally important, whereas Cold War rationality emanated primarily from the conceptual publications of a handful of well-funded think tanks, which tended to understand national populations and everyday culture as masses that need to be guided, smartness pervades cell phones, delivery trucks, and health-care systems and relies on the interactions among, and the individual idiosyncrasies of, millions or even billions of individuals around the planet. Moreover, whereas Cold War rationality was dominated by the thought of the doppelgänger rival (e.g., the US vs. the USSR, the East vs. the West), smartness is not limited to binaries.[5] Rather, it understands threats as emerging from an environment that, because it is always more complex than the systems it encompasses, can never be captured in the simple schemas of rivalry or game theory. This in turn allows smartness to take on an ecological dimension: the key crisis is no longer simply that emerging from rival political powers or nuclear disaster but rather, more fundamentally, intrinsically unforeseeable events that will necessarily continue to emerge from an always too-complex environment.

If smartness is what follows after Cold War understandings of reason and rationality, the smartness mandate is the political imperative that smartness be extended to all areas of life. In this sense, the smart mandate is what comes after the *shock doctrine*, powerfully described by Naomi Klein and others.[6] As Klein notes in her book of the same name, the shock doctrine was a set of neoliberal assumptions and techniques that taught policy-makers in the 1970s to take advantage of crises to downsize government and deregulate in order to extend the rationality of the free market to as many areas of life as possible. The smart mandate, we suggest, is the current instantiation of a new technical logic with equally transformative effects on conceptions and practices of governance, markets, democracy, and even life itself. Yet where the shock doctrine imagined a cadre of experts and advisers deployed to various national polities to liberate markets and free up resources during moments of crisis, the smartness mandate both understands crisis as the normal human condition and extends itself by means of a field of plural agents—including environments, machines, populations, and data sets—that interact in complex manners and without recourse to what was earlier understood as reason or intelligence. If the shock doctrine promoted the idea that systems had to be fixed so that natural economic relationships could express themselves, the smartness mandate aims instead at resilience and practices management without ideals of futurity or clear measures of success or failure. We describe this imperative of developing and instantiating smartness everywhere as a *mandate* in order to capture both its political implications—though smartness is presented by its advocates as politically agnostic, it is more accurate to see it as reconfiguring completely the realm of the political—and the premise that smartness is only possible by drawing upon the *collective intelligence* of large populations.

We illuminate the deep logic of smartness and its mandate in four chapters, each focused on a different aspect of the smartness mandate. These chapters take up the following questions:

1. What is the *agent* of smartness (i.e., what, precisely, enacts or possesses smartness)?
2. Where does smartness happen (i.e., what kind of *space* does smartness require)?
3. What is the key operation of smartness (i.e., what does smartness do)?
4. What is the purported result of smartness (i.e., at what does it aim)?

Our answers to these four questions are as follows:

1. The (quasi-)agents of smartness are *populations*.
2. The territory of smartness is *the experimental zone*.
3. The key operation of smartness is *derivation*.
4. Smartness produces *resilience*.

Focusing on how the logics and practices of populations, experimental zones, derivation, and resilience are coupled enables us to illuminate not simply particular instantiations of smartness—for example, smart cities, grids, or phones—but smartness more generally and its mandate ("every process must become smart!").

Our analysis draws inspiration from Michel Foucault's concepts of governmentality and biopolitics, Gilles Deleuze's brief account of "the control society," and critical work on immaterial labor. We describe smartness genealogically—that is, as a concept and practices that emerged from the coupling of logics and techniques from multiple fields, including ecology, computer science, and government policy. We also link smartness to the central object of biopolitics—namely, populations—and see smartness as bound up with the key goals of biopolitics and governmentality. We emphasize the importance of a mode of control based on what Deleuze describes as open-ended modulation, rather than the permanent molding of discipline. We also underscore the centrality of data drawn from the everyday activities of large numbers of people. Yet insofar as smartness positions the global environment as the fundamental orienting point for all governance—that is, as the realm of governance that demands that all other problems be seen from the perspective of experimental zones, populations, resilience, and optimization—the tools offered by existing concepts of biopolitics, the control society, and immaterial labor take us only part of the way in our account.[7]

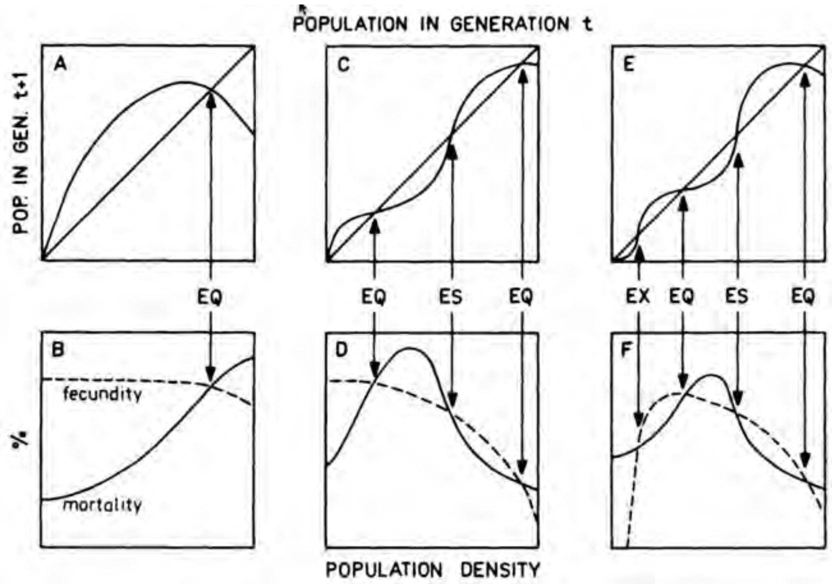
POPULATIONS

Populations are the agents—or more accurately, the *enabling medium*—of smartness. Smartness is located neither in the source (producer) nor in the destination (consumer) for a product such as a smartphone but is rather the outcome of the algorithmic manipulation of billions of traces left by thousands, millions, or billions of individual users. Smartness requires these large populations, for they are the medium of what we will call the *partial perceptions* within which smartness emerges. Although, as we discuss below, these populations should be understood as fundamentally biopolitical in nature, it is more helpful first to recognize the extent to which smartness relies on an understanding of populations drawn from twentieth-century biological sciences such as evolutionary biology and ecology (figure I.1).

Biologists and ecologists often use the term "population" to describe large collections of individuals with the following characteristics:

1. Each member of the population differs at least slightly from one another.
2. These differences allow some individuals to be more "successful" vis-à-vis their environment than other individuals.
3. There is a form of memory that enables differences that are successful to appear again in subsequent generations.
4. As a consequence of (3), the distribution of differences across the population tends to change over time.[8]

This emphasis on the importance of individual differences for long-term fitness thus distinguishes this use of the term "population" from more common political uses of the term to describe the individuals who live within a political territory.[9]



I.1 Diagram speculating on various futures for population reproduction curves and for deriving fecundity and morbidity (*bottom row*) from these different possible curves. *Source*: C. S. Holling, "Resilience and Stability of Ecological Systems," *Annual Review of Ecological Systems* 4 (1973): 1–23, 21.

Smartness takes up a biologically oriented concept of population but repurposes it for nonbiological contexts. Smartness presumes that each individual is not only biologically distinct but also distinct in terms of "social" characteristics such as habits, knowledge, and consumer preferences, and that information about these individual differences can be usefully grouped together so that algorithms can locate subgroupings of this data that thrive or falter in the face of specific changes. Though the populations of data drawn from individuals may map onto traditional biological or political divisions, groupings and subgroupings might also revolve around consumer preferences and could be drawn from individuals in widely separated geographical regions and polities (for example, Netflix's populations of movie preferences are currently created from users distributed throughout 190 countries).[10] Moreover, though these data populations are (generally) drawn from humans, they are best understood as distinct from the human populations from which they emerge: these are simply data populations of, for example, preferences, reactions, or abilities.

This is true even in the case of information drawn from human bodies located in the same physical space. In the case of the smart city, the information streaming from Fitbits, smartphones, credit cards, and transport cards is generated by human bodies in close physical proximity to one another, but individual data populations are then agglomerated at different temporalities and scales, depending on the problem being considered (for example, transportation routing, energy use, or consumer preferences). These discrete data populations enable processes to be optimized (i.e., enable "fitness" to be determined), which in turn produces new populations of data and hence a new series of potentialities for what a population is and what potentials these populations can generate.

A key premise of smartness is that while each member of a population is unique, the population is also "dumb"—that is, limited in its perception—and that smartness emerges as a property of the population as a whole only when these limited perspectives are linked via environment-like infrastructures. Returning to the example of the smartphone operating in a smart city, the phone becomes a mechanism for creating data populations that operate without the cognition or even the direct command of the subject (the smartphone, for example, automatically transmits its location and can also transmit other information about how it has been used). If populations enable long-term species survival in the biological domain, then populations enable smartness in the cultural domain, provided that populations are networked together with smart infrastructures. Populations are part of the perceptual substrate that enables modulating interactions among agents within a system that sustains particular activities. The infrastructures ensure, for example, that "given enough eyeballs, all bugs are shallow" (Linus's law); that problems can be crowdsourced; that there can be collective intelligence; and so on.[11]

This creation and analysis of data populations is clearly biopolitical in the sense initially outlined by Michel Foucault, but it is also vital to recognize smartness as a significant mutation in the operation of biopolitics. As Foucault stressed, the concept of population was central to the emergence of biopolitics in the late eighteenth century, for it denoted a collective body that had its own internal dynamics (of births, deaths, illness, etc.), which were quasi-autonomous in the sense that they could not be commanded or completely prevented by legal structures but could nevertheless be subtly altered through biopolitical regulatory techniques and technologies (for example, required inoculations or free-market mechanisms).[12] On the one hand, smartness is biopolitical in this same sense, for the members of its populations—movie watchers, cell phone users, health-care purchasers and users, and so on—are assumed to have their own internal dynamics and regularities, and the goal of gathering information about these dynamics is not to discipline individuals into specific behaviors but rather to find points of leverage within these regularities that can produce more subtle and widespread changes.

On the other hand, the biopolitical dimension of smartness cannot be understood as simply "more of the same" for four reasons. First, and in keeping with Deleuze's reflections on the control society, the institutions that gather data about populations are now more likely to be corporations rather than the state.[13] Second, and as a consequence of the first point, smartness's data populations often concern not those clearly biological events on which Foucault focused but rather variables such as attention, consumer choices, and transportation choices. Third, although the data populations that are the medium of smartness are drawn from populations of humans, this data relates differently to individuals than do Foucault's more health-oriented examples. Data populations themselves often do not need to be (and sometimes cannot be) mapped directly back onto discrete human populations: one is often less interested in discrete events that happen only once in the individual biographies of the members of a polity (e.g., a smallpox infection) than in frequent events that may happen across widely dispersed groups of people (e.g., movie preferences). The analysis of these data populations is then used to create, via smart technologies, an individual and customized information environment around each individual, which aims not to discipline individuals, in Foucault's sense, but to extend ever deeper and further the quasi-autonomous dynamics of populations. Fourth, in the case of systems such as high-speed financial trading and derivatives and in the logistical management of automated supply chains, entire data populations are produced and acted upon directly through machine-to-machine data gathering, communication, analytics, and action.[14] These new forms of automation and of producing populations mark transformations in both the scale and intensity of the interweaving of algorithmic calculation and life.

ZONES

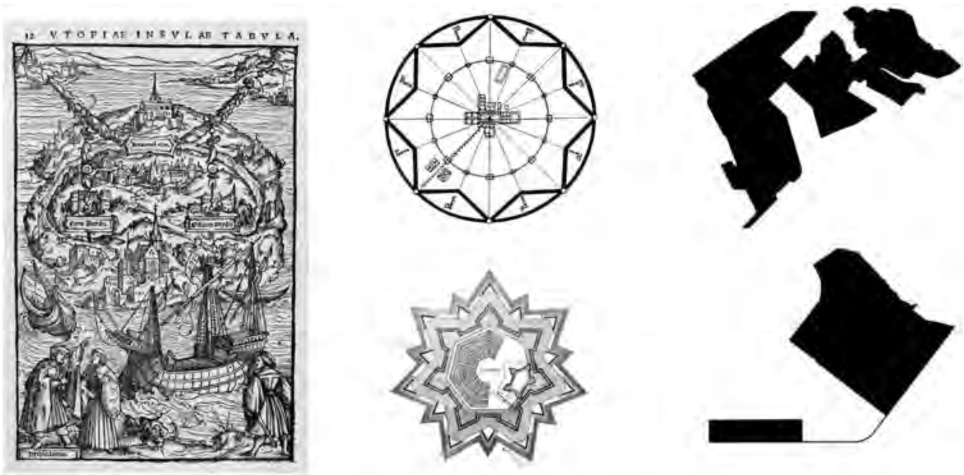
Smartness has to happen somewhere. However, because the agents, or media, of smartness are globally distributed populations, the geography of smartness no longer follows traditional political borders. Advocates of smartness generally imply or explicitly note that the space of smartness is not that of the national territory. Palmisano's invocation of a smarter planet, for example, emphasizes the extraterritorial space that smartness requires: precisely because smartness aims in part at ecological salvation, its operations cannot be restricted to the limited laws, territory, or populations of a given national polity. Designers of smart homes likewise imagine a domestic space freed by intelligent networks from the physical constraints of the traditional home while the fitness app on a smartphone conditions the training of a single user's body through iterative calculations correlated with thousands or millions of other users across multiple continents.[15] These activities all occur in space, but the nation-state is neither their obvious nor necessary container, nor is the human body and its related psychological subject their primary focus, target, or even paradigm (e.g., smartness often employs entities such as *swarms* that are never intended to cohere in the manner of a rational or liberal subject).

At the same time, smartness also depends on complicated and often delicate infrastructures, such as fiber-optic cable networks and communication systems capable of accessing satellite data or server farms that must be maintained at precise temperatures or safe shipping routes that are invariably located at least in part within national territories and often subsidized by federal governments. Smartness thus also requires the support of legal systems and policing to protect and maintain these infrastructures, and most of the latter are provided by nation-states (even if partially in the form of subcontracted private security services).[16]

This paradoxical relationship of smartness to national territories is best understood as a mutation of the contemporary form of space known as zones. Related to histories of urban planning and development, where zoning has long been an instrument in organizing space, contemporary zones have new properties married to the financial and logistical practices that underpin their global proliferation. In the past two decades, urban historians and media theorists have redefined the zone in terms of its connection to computation and described the zone as the dominant territorial configuration of the present. As architectural theorist Keller Easterling notes, the zone should be understood as a method of *extrastatecraft* intended to serve as a platform for the operation of a new "software" for governing human activity. Brett Nielsen and Ned Rossiter invoke the figure of the *logistical city* or zone to make the same point about governmentality and computation.[17]

Zones do not denote the demise of the state but rather the production of new forms of territory. One important modality of this new form is a space of exception to national and often international law. A key example is the so-called free-trade zone. Free-trade zones are a growing phenomenon, stretching from the Pudong district in Shanghai to the Cayman Islands to the business districts and port facilities of New York State, and are promoted as conduits for the smooth transfer of capital, labor, and technology globally (with "smooth" defined as a minimum of delay as national borders are crossed). Free-trade zones are in one sense discrete physical spaces, but they also require new networked infrastructures linked through the algorithms that underwrite geographic information systems, global positioning systems, and computerized supply chain management systems, as well as the standardization of container and shipping architecture and regulatory legal exceptions (to mention just some of the protocols that produce these spaces). Equally as important is that zones are understood to be outside the legal structure of a national territory, even if they technically lie within its space.[18]

In using the term "zone" to describe the space of smartness, our point is not that smartness happens in places such as free-trade zones but rather that smartness aims both to globalize and, simultaneously, render more experimental the logic of zones. This logic of geographic abstraction, detachment, and exemption is exemplified even in a mundane consumer item such as activity monitors—for example, the Fitbit—that link data about the physical activities of a user in one jurisdiction with the data of users in other jurisdictions. This logic of abstraction is more fully exemplified by the emergence of so-called smart cities. An organizing principle of the smart city is that automated and ubiquitous data collection will drive, and perhaps replace, civic governance and public taxation. This ideal of a "sensorial" city that serves as a conduit for data gathering and circulation is a primary fantasy enabling smart cities, grids, and networks. Consider, for example, a prototype *greenfield*—that is, designed from the ground up—smart city development, such as Songdo in South Korea (figure I.2). This smart city is designed with a massive sensor infrastructure for collecting traffic, environmental, and closed-circuit television data and includes individual smart homes (apartments) with multiple monitors and touch screens for temperature control, entertainment, lighting, and cooking functions. The city's developers also hope that these living spaces will eventually monitor multiple health conditions through home testing. Implementing this business plan, however, will require significant changes to, or exemptions from, South Korean laws about transferring health information outside of hospitals. Lobbying efforts for this juridical change have been promoted by Cisco Systems (a US-based network infrastructure provider), the Incheon Free Economic Zone (the governing local authority), and POSCO (a Korean chaebol, i.e., a large family-controlled



I.2 Ideal zonal imaginaries for cities. *Left*: Utopia by Sir Thomas More (1518). *Upper middle*: Sforzinda by Filarete (fifteenth–sixteenth century). *Lower middle*: Coevorden (the Netherlands, early seventeenth century). *Upper right*: Jurong Island, Singapore. *Lower right*: Songdo smart city, Incheon, South Korea, master plan, 2012. *Source*: Orit Halpern, Jesse LeCavalier, and Nerea Calvillo, "Test-Bed Urbanism," *Public Culture* 25, no. 2 (March 2013): 272–306, 275.

conglomerate that, in this case, focuses on construction and steel refining), formerly the three most dominant forces behind Songdo.

What makes smart territories unique in a world of zonal territories is the specific mode by which smartness colonizes space through the management of time (and this mode also helps explain why smartness is so successful at promulgating itself globally). We focus in this book on the prototype or demo nature of contemporary zones and the relationship of prototyping to catastrophe. As underscored in our opening example of Palmisano's speech, smartness is predicated on an imaginary of crisis that is to be managed through a massive increase in sensing devices, which in turn purportedly enable self-organization and constant self-modulating and self-updating systems. That is, smart platforms link zones to crisis via two key operations: a temporal operation, by means of which uncertainty about the future is managed through constant redescription of the present as a version, demo, or prototype of the future, and an operation of self-organization, through which earlier discourses about structures and *the social* are replaced by concerns about infrastructure, a focus on sensor systems, and a fetish for big data and analytics, which purportedly can direct development even in the absence of clearly defined ends or goals.

To put this another way, so-called smart cities such as Songdo follow a logic of software development. Every present state of the smart city is understood as a demo or prototype of a future smart city; every operation in the smart city is understood in terms of testing and updating. Engineers interviewed at Songdo openly spoke of it as an "experiment" and as a "test," admitting that many parts of the system currently did not work but stressing that problems could be fixed in the next instantiation elsewhere in the world.[19] As a consequence, there is never a finished product but rather infinitely replicable yet always preliminary, never-to-be-completed versions of these cities around the globe.

This temporal operation of demo-ing is linked to an ideal of self-organization. Smartness largely refers to computationally and digitally managed systems, from electrical grids to building management systems, that can learn and, in theory, adapt by analyzing data about themselves. Self-organization is thus linked to the operation of optimization (which we discuss in more detail below). Systems are to correct themselves automatically in relationship to their own operations. This organization is imagined as being immanent to the physical and informational system at hand—that is, optimized by computationally collected data rather than by external political or social actors. At the heart of the smartness mandate is thus a logic of immanence, by means of which sensor instrumentation adjoined to emerging and often automated methods for the analysis of large data sets allows a dynamic system to detect and direct its perpetual evolution.[20]

Our notion of zonal territories thus refers to a form of governance that is both spatial and temporal. The form of space is one of processes and practices, and we focus on the modulatory nature of these spaces. Smart zones are malleable: they are not static spaces, nor are they clearly delineated or taxonomically organized areas. Unlike the historic zoning of cities into commercial, private, and industrial spaces, demo-zones constantly rearrange these terms according to the mandates of emergency and computation. Instead of urban master plans or even utopian visions of cities that characterized (even if as ideals rather than as actual realities) earlier twentieth-century understandings of planning, smart zones operate instead by means of concepts of constant experimentation and feedback that transform space.

One of the key, and troubling, consequences of demo-ing and self-organization as the two zonal operations of smartness is that the overarching concept of crisis comes to obscure differences in various types of catastrophes. While every crisis event—for example, the 2008 subprime mortgage collapse or the Tohoku earthquake of 2011—is different, within the demo-logic that underwrites the production of smart and resilient cities, these differences can be subsumed under the general concept of crisis and addressed through the same methods (the implications of which must never be fully engaged because we are always demo-ing or testing solutions, never actually solving a stable underlying problem). Whether threatened by terrorism, subprime mortgages, energy shortages, or hurricanes, smartness always responds in essentially the same way. The demo is thus a form of temporal management that through its practices and discourses evacuates historical and contextual specificity of particular catastrophes and evades ever having to assess or represent the impact of these infrastructures because no project is ever "finished." It is this evacuation of differences, temporalities, and societal structures that most concerns us in confronting the extraordinary rise of ubiquitous computing and high-tech infrastructures as solutions to political, social, environmental, and historical problems.

DERIVATION

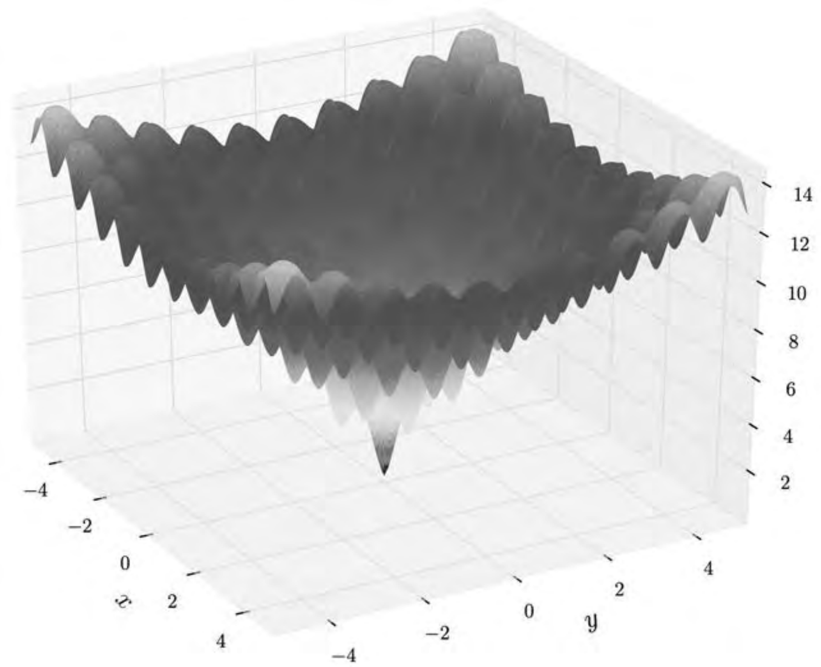
Smartness emerges when zones and increasingly fine-grained observations of the quasi-autonomous dynamics of populations are linked through *optimization processes* that are themselves oriented toward what we call a *logic of derivation*—that is, temporal technologies able to exploit current computational limits as both a present source of value and a hedge against an always unknowable and threatening future. Though optimization and derivation are quite different concepts and technical methods of optimization and derivation have different lineages, smartness links these two operations by orienting optimization toward the logic of derivation and derivatives.

Optimization as a concept and set of techniques is often understood as a synonym for "efficiency" and is equated with the techniques of industrial production and the sciences of efficiency and fatigue pioneered in the late nineteenth and early twentieth centuries by Fredrick Winslow Taylor and Frank Gilbreth.[21] In the context of smartness, though, notions of optimization defer and often displace older concerns with energy and entropy in important ways that separate its current reality from histories of efficiency. Though the history of optimization has yet to be written, the term itself seems to have entered common usage in English only in the 1950s via interrelated fields such as electrical engineering, computer research, and game theory.[22] For these discourses, "to optimize" meant to find the best relationship between the minima and maxima performances within a well-defined system or space. Optimization was not a normative or absolute measure of performance but an internally referential and relative one: for *this* system, given *these* goals and *these* constraints, the optimal solutions is X. The effort to locate the one choice that provides the least cost and most benefit also defines much of the thinking about the economic agent in the second half of the twentieth century. The claim advanced by neoliberal economists beginning in the 1950s that *every* kind of conscious human activity, including choices about education, voting, and marriage partners, should be understood as fundamentally economic is also indebted to this understanding of technical optimization. Optimization is in this sense a key technique by which smartness promulgates the belief that everything—every kind of relationship among humans, their technologies, and the environments in which they live—can and should be algorithmically managed. Shopping, dating, exercising, the practice of science, the distribution of resources to public schools, the fight against terrorism, the calculation of carbon offsets and credits: all of these processes can—and must!—be optimized. It is in part this pursuit of "the best"—the fastest route between two points, the most reliable prediction of a product consumers will like, the least expenditure of energy in a home, the lowest risk and highest return in a financial portfolio, and so on—that implicitly justifies the term "smartness."

At the same time, however, twentieth-century technical optimization procedures are almost always linked to limits, or even failure, and smartness involves a very specific approach to such optimization failures—namely, deriving value from failure by means of "learning." This constitutes a break from the older models of efficiency grounded in energy consumption and materials. The development of calculus in the eighteenth century encouraged the hope that if one could simply find an equation for a curve that described a system, it would then always be possible in principle to locate the *absolute*, rather than simply local, maxima and minima for a system. Yet the problems engaged by twentieth-century electrical and computer engineers often had so many variables and dimensions that it was impossible, even in principle, to solve an equation completely. As computer scientist Dan Simon notes, even a problem as apparently simple as determining the most optimal route for a salesperson who needs to visit 50 cities would be impossible were one to try to calculate all possible solutions. There are 49! ($=6.1\times10^{62}$) possible solutions to this problem, which is beyond the capability of contemporary computing: even if one had a trillion computers, each capable of calculating a trillion solutions per second, and these computers had been calculating since the universe began—a total computation time of 15 billion years—they would not yet have come close to calculating all possible routes.[23]

In the face of the impossibility of determining the absolute maxima or minima for these systems using the so-called brute force approach (i.e., calculating and comparing all possible solutions), optimization often involves finding good-enough solutions: maxima and minima that may or may not be absolute but are more likely than other solutions to be close enough to absolute maxima or minima to allow systems to continue operating without additional investment. The optimizing engineer selects among different algorithmic methods that each produce, in different ways and with different results, good-enough solutions.[24]

Yet for real-world problems, any particular optimization method may fail, in the sense that it becomes trapped by local minima or maxima (see figure I.3). Smartness relies on seeing failed optimization as an occasion for learning. In some cases, such learning is intended to mimic natural processes, especially computational ideals of biological evolution, which



I.3 The Ackley function for two-dimensional space: $f(x,y) = -20\exp\left[-0.2\sqrt{0.5(x^2+y^2)}\right] - \exp[0.5(\cos 2\pi x + \cos 2\pi y)] + e + 20$. The absolute minimum of this function is zero. However, since it contains many closely clustered local minima, some evolutionary optimization algorithms find the absolute minimum difficult to locate. Different evolutionary optimization algorithms can thus be tested on this function to determine how close each can get to the absolute minimum.

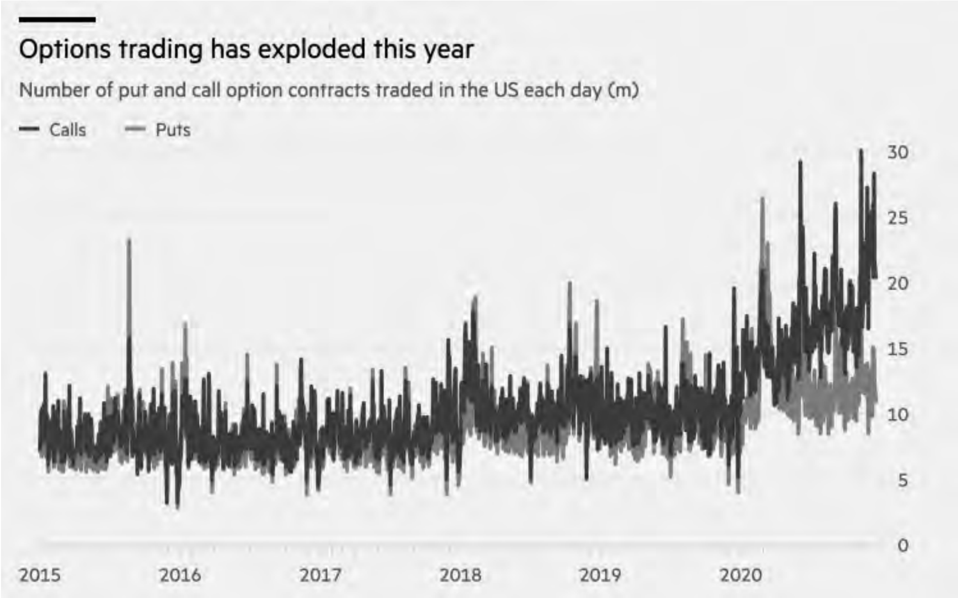
reframe local failure as part of a broader strategy of perpetual testing for new solutions. Evolutionary optimization algorithms, for example, begin with the premise that natural biological evolution automatically solves optimization problems by means of natural biological populations. It then seeks to simulate that process by creating populations of candidate solutions, which are mixed with one another (elements of one candidate solution are combined with elements of other candidate solutions) and culled through successive generations to produce increasingly good solutions. David B. Fogel, a consultant for the informatics firm Natural Selection Inc., which applies computational models to the streamlining of commercial activities, captures this sense of optimization as simply a continuation of nature's work: "Natural evolution is a population-based optimization process. Simulating this process on a computer results in stochastic optimization techniques that can often outperform classical methods of optimization when applied to difficult real-world problems."[25]

Optimization research implements these features (reproduction, mutation, competition, and selection) in computers in an effort to find "natural" laws that can govern the organization of industrial or other processes that, when implemented on a broad scale, become the conditions of life itself.

The premise that systems can never be fully and finally optimized, if only because their environments change, also propels the demand for ever more sensors—more sites of data collection, whether via mobile device apps, hospital clinic databases, tracking of website clicks, and so on—so that optimization's realm can be perpetually expanded and optimization itself further optimized.

Yet treating failed optimization as an occasion for learning also requires time-based strategies for mitigating the consequences of such failures, and in the case of smartness, this means enframing optimization within a logic of derivation. A financial derivative—for example, a currency future option that gives the purchaser the right, but not obligation, to purchase the currency in the future at an exchange price agreed upon in the present—can be used to guard against the risk that the value of that underlying asset (the specific currency in question) will decrease in the future. These kinds of financial derivatives have been used by corporations that are based in one country but do business in another since significant changes in currency exchange rates can spell disaster for a company's bottom line if, for example, it invested in equipment at one currency exchange rate but several years later received payments for its products at a much lower currency exchange rate. Corporations and individuals can hedge against risk even more by bundling different derivatives together, resulting in derivatives that can eventually have very attenuated relationships to the underlying assets. (This was the case in the famous credit-swap derivatives that propelled the US housing market crisis that began in 2007, in which a single derivative might contain tiny slices of thousands of housing loans). As we will discuss at more length in our chapter on derivation, this operation is a means for managing uncertainty and for making what might otherwise be seen as extraordinarily dangerous or life-threatening decisions—for example, continuing to burn massive amounts of carbon despite clear evidence that this is changing the global climate for the worse—seemingly risk-free. Derivation thus enframes optimization by extracting value from the assumed repeat failure of optimization in the present and the demand to learn in the future. That is to say, derivative practices are betting that the future is not known, and the present may be imperfectly optimized—and this difference can be a source of speculation (see figure I.4).

The logic of derivation is perhaps most clearly exemplified by, but is not limited to, financial derivatives. We can see the same logic of reallocating risks (often unfairly) and deferring issues of responsibility in the arena of national security data analysis. Ethicist Louise Amoore describes how this same logic plays out in British homeland security software design. Software designers seek to help automate *risk flags* for border agents. While some of these risk flags are determined by traditional pieces of information that bear upon a traveler's identity—for example, passport or visa information—other details bear upon choices that do not seem intrinsic to personal identity at all, such as how close to departure a ticket was purchased, by what means it was purchased (cash or credit), and what meal a passenger selected. These latter pieces of information help establish an ever-changing norm of what "normal" travel looks like and allow the software program to compare each traveler with that shifting norm. Moreover, each time the software creates an erroneous red flag, that failure can be used to further refine the algorithm. Amoore calls this



I.4 Chart of options trading during the COVID-19 pandemic. *Source*: *Financial Times*, December 21, 2020, https://www.ft.com/content/19cb6aa3-a390-4ed6-a695-9a1e700f35b6.

separation of data from the individual and its rebundling with thousands of other pieces of data, all with an eye toward determining whether an individual might pose a security risk, a *data derivative*.[26] In chapter 3, on derivation, we take up her point that, through such automation, responsibility for decisions is deferred or evaded, just as financial derivatives allow traders to hedge against risk without becoming legally responsible for the shaky investments they enable. That is, in derivative logic, value is extracted by shorting the bet, which also means never having to engage the consequences of an action or the future produced through these trades.

The derivative logic of optimization serves to justify the extension and intensification of the zonal logic of smartness. In order to optimize all aspects of existence, smartness must be able to locate its relevant populations (of preferences, events, etc.) wherever they occur. However, this is only possible when every potential data point (i.e., partial perception) on the globe can be directly linked to every other potential data point without interference from specific geographic jurisdictional regimes. As we noted above, this does not mean the withering of geographically based security apparatuses; on the contrary, derivation often requires strengthening the latter in order to protect the concrete infrastructures and financial investments that enable smart networks and their optimization protocols.

RESILIENCE

If smartness happens through experimental zones, if its operations require populations, and if it aims most fundamentally at derivation, what is the telos of smartness itself—that is, at what does smartness aim, and why is smartness understood as a virtue? The answer is that smartness enables *resilience*; this is its goal and raison d'être. The logic of resilience is peculiar in that it aims not precisely at a future that is "better" in any absolute sense but rather at a smart infrastructure that can absorb constant shocks while maintaining functionality and organization. Following the work of Bruce Braun and Stephanie Wakefield, we describe resilience as a state of permanent management that does away with guiding ideals of progress, change, or improvement.[27]

The term "resilience" plays important, though differing, roles in multiple fields. These include engineering and material sciences: since the nineteenth century, the modulus of resilience has measured the capacity of materials such as woods and metals to return to their original shape after impact. Resilience is also an important term in ecology, psychology, sociology, geography, business, and public policy, in which it names ways in which ecosystems, individuals, communities, corporations, and states, respectively, respond to stress, adversity, and rapid change.[28] However, the understanding of resilience most crucial to smartness and the smartness doctrine was first forged in ecology in the 1970s, especially in the work of C. S. Holling, who established a key distinction between stability and resilience. Working from a systems perspective and intrigued by the question of how humans could best manage elements of ecosystems that were of commercial interest (e.g., salmon, wood, etc.), Holling developed the concept of resilience to contest the premise that ecosystems were healthiest when they returned quickly to an equilibrium state after being disturbed (and in this sense his paper critiqued then-current industry practices).

Holling defined *stability* as the ability of a system that had been perturbed to return to a state of equilibrium, but he argued that stable systems were often unable to compensate for significant, swift environmental changes. As Holling put it, the "stability view [of ecosystem management] emphasizes the equilibrium, the maintenance of a predictable world, and the harvesting of nature's excess production with as little fluctuation as possible." However, he continued, this approach cannot take into account that "a stable maximum sustained yield of a renewable resource might so change [the conditions of that system] . . . that a chance and rare event that previously could be absorbed can trigger a sudden dramatic change and loss of structural integrity of the system."[29] Resilience, by contrast, denoted for Holling the capacity of a system *to change* during periods of intense external perturbation and thus a capacity to persist over much longer time periods than in the case of stable systems. The concept of resilience encourages a management approach to ecosystems that "emphasize[s] the need to keep options open, the need to view events in a regional rather than a local context, and the need to emphasize heterogeneity" (see figure I.5). Resilience is in this sense linked to concepts of crisis and states of exception, for resilience is a virtue only when the latter are assumed to be quasi-constant. Holling also underscored that the movement from stability to resilience depended upon an epistemological shift: "Flowing from this [understanding of resilience] would be not the presumption of sufficient knowledge, but the recognition of our ignorance: not the assumption that future events are expected, but that they will be unexpected."[30]

Smartness abstracts the concept of resilience from ecology and turns it into an all-purpose epistemology and value, positing resilience as a more general strategy for managing perpetual uncertainty in all fields and encouraging the premise that the world is indeed so complex that unexpected events are the norm. Smartness enables this generalization of resilience in part because it abstracts the concept of populations from the specifically biological sense employed by Holling: in addition to populations of individual organisms, smartness also sees populations of preferences, traits, and algorithmic solutions. Resilience also functions in

I.5 An example of resilient design: experimental floating wetlands on the Charles River, Boston, designed to suppress algal blooms. Constructed by Northeastern University. *Source*: Photo by Orit Halpern, December 30, 2020.

the discourse of smartness to collapse the distinction between *emergence* (something new) and *emergency* (something new that threatens). By collapsing this distinction, resilience produces a world in which any change purportedly can be technically managed and assimilated by maintaining the ongoing survival of the system rather than the survival of individuals, or even particular groups of individuals. Smartness thus focuses on the management of the *relationships between* different populations of data, some of which can be culled and sacrificed for systemic maintenance.[31] In doing so, resilience is a key functionary in what Jennifer Gabrys has called "the becoming environmental of computing" and in what Benjamin Bratton has labeled "planetary scale computing."[32] Smartness makes the environment into a medium while explicitly transforming evolution. Planned obsolescence and preemptive destruction combine here to encourage the introduction of ever more computation into the environment, as well as emphasize that resilience of the species may necessitate sacrifices of "suboptimal" populations.

The discourse of resilience effectively erases the differences among past, present, and future. Time is understood not through a historical or progressive schema but rather through schemas of repetition and recursion (the same shocks, and the same methods, are repeated again and again), even as these repetitions and recursions produce constantly differing territories. This is a self-referential difference only measured or understood in relation to the many other versions of smartness (e.g., earlier smart cities), which all tend to be built by the same corporate and national assemblages.

The collapse of emergence into emergency also links resilience to financialization through derivation, as the highly leveraged complex of Songdo already demonstrated.[33] The links that resilience establishes among emergency, financialization, and derivatives is also exemplified by New York City, which, after the devastation of Hurricane Sandy in 2012, adopted the slogan "Fix and Fortify." This slogan underscores an acceptance of future shock as a necessary reality of urban existence while at the same time leaving the precise nature of these shocks unspecified (though they are often implied to include terrorism as well as environmental devastation). The naturalization of this state is vividly demonstrated by the irony that the real destruction of New York had earlier been imagined as an opportunity for innovation, design thinking, and real-estate speculation. In 2010, shortly before the real hurricane hit New York, the Museum of Modern Art and PS1 ran a design competition and exhibition titled *Rising Currents*, which challenged the city's premier architecture and urban design firms to design for a city ravaged by rising sea levels as a result of global warming:

> MoMA and PS1 Contemporary Art Center joined forces to address one of the most urgent challenges facing the nation's largest city: sea-level rise resulting from global climate change. Though the national debate on infrastructure is currently focused on "shovel-ready" projects that will *stimulate the economy*, we now have an important *opportunity* to foster *new research and fresh thinking* about the use of New York City's harbor and coastline. As in past economic recessions, construction has slowed dramatically in New York, and much of the city's *remarkable pool of architectural talent is available* to focus on innovation.[34]

It is difficult to imagine a clearer statement about the ideal relationship of urban planners to crisis: planning must simply assume and assimilate future, unknowable shocks, and these shocks may come in any form. This rather stunning statement turns economic tragedy, the unemployment of most architects, and the imagined coming environmental apocalypse into an opportunity for speculation (with *speculation* understood to be simultaneously a technical, aesthetic, and economic operation). This is a quite literal transformation of emergency into emergence and of creating a model for managing perceived and real risks to the population and infrastructure of the territory not by "solving" the problem but by absorbing shocks and modulating the ways in which the environment is managed. New York in the present becomes a mere demo for postcatastrophe New York, and the differential between these two New Yorks is the site of financial, engineering, and architectural interest and speculation.

This relationship of resilience to the logic of demos and derivatives is illuminated by the distinction between risk and uncertainty first proposed in the 1920s by the economist Frank Knight. According to Knight, uncertainty, unlike risk, has no clearly defined end points or values.[35] It offers no clear-cut terminal events. If the geopolitical dynamics of the Cold War understood nuclear testing and simulation as a means of avoiding an unthinkable but nonetheless predictable event—nuclear war—the formula has changed; we now live in a world of fundamental uncertainty, which can only ever be partially and provisionally captured through discrete risks. When uncertainty, rather than risk, is understood as the fundamental context, "tests" can no longer be understood primarily as a simulation of life; rather, the test bed makes human life itself an experiment for uncertain technological futures. Uncertainty thus embeds itself in our technologies, both of architecture and finance. In financial markets, for example, risks that are never fully accounted for are continually "swapped," "derived," and "leveraged," in the hope that circulation will defer any need to actually represent risk, and in infrastructure, engineering, and computing, we do the same.[36]

As future risk is transformed into uncertainty, smart and ubiquitous computing infrastructures become the language and practice by which to imagine and to create our future. Instead of looking for utopian answers to our questions regarding the future, we focus on quantitative and algorithmic methods and on logistics; on how to move things from point A to point B rather than questions of where they *should* end up (or whether they should be there at all). Resilience as the goal of smart infrastructures of ubiquitous computing and logistics becomes the dominant method for engaging with possible urban collapse and crisis (as well as the collapse of other kinds of infrastructure, such as those of transport, energy, and finance). Smartness thus becomes the organizing concept for an emerging form of technical rationality, the primary goal of which is management of an uncertain future through a constant deferral of future results; for perpetual evaluation through a continuous mode of self-referential data collection; and for the construction of forms of financial instrumentation and accounting that no longer engage, or even need to engage, with what capital extracts from history, geology, or life.

GENEALOGIES

Each of the four chapters in this book focuses on one term—“populations,” “experimental zones,” “optimization/derivation,” and “resilience”—and provides a genealogy of the concepts, techniques, and technologies that led to the present function of these concepts and their associated technologies within the smartness mandate. As will be evident in our chapters, each term emerged, and was engaged, within multiple discourses and technologies, including ecosystem ecology, evolutionary biology, management science, computer science, and economics, to name just a few. There was, in addition, often significant cross talk and conceptual and technical borrowing among these disciplines. On the one hand, this complexity makes a complete, or comprehensive, genealogy of smartness difficult and perhaps even impossible. On the other hand, this complexity underscores the need for a mapping of the sort provided by this book. However, we do not consider our account to be the only possible genealogy of smartness, and we can imagine other genealogies that focus on different authors, engineers, and techniques. Though our genealogy is intended to illuminate the deep logic of smartness—a logic that would also apply to alternate genealogical accounts—we employ excurses in each chapter to gesture both toward the fact that our account is one of several possible ways to explain the rise of the smartness mandate and that the current smartness mandate was *not* the only possible outcome of the techniques and concepts we describe.

In constructing our genealogy of the smartness mandate, we drew on earlier work in the history of science, science and technology studies (STS), media studies, and urban/design studies. We found especially helpful the work of historians of science and STS scholars who have focused on the history of cybernetics and on the histories of changing scientific conceptions of rationality.[37] We drew inspiration from Paul N. Edwards's *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming*, which documents the multiple scientific techniques, discourses, and political projects that became linked to enable *climate modeling*.[38] Equally important to us have been the histories of environmentality and environment developed by scholars such as Peder Anker (and especially the links he draws among ecology, architecture, cybernetics, and empire), as well as Etienne Benson's work on *environmentalisms*, which underscores both the historical contingency of definitions of environment (and therefore also of models of environment and the types of actions understood as typical of environments) and the relationship of these definitions to media.[39]

Indeed, a core theme in this book is the transformation of *environment* into a media surround that is also a political ecology, to borrow from Fred Turner.[40] Just as climate is both the product and producer of media, the control of climate is also about the control of populations, as Yuriko Furuhata, Nicole Starosielski, and Daniel Barber have shown. How climate is managed, whether by means of air-conditioning or by building management systems that are smart, depends upon premises about the human subject, about the norms of the body, and about how social order can be organized through spatial relations. In these cases, climate as medium is also climate as biopolitics and relations of power. These relations of power include both colonial and postcolonial relations and relations between the Global North and South. As these authors have argued, evolving understandings of climate, environment, population, and media were central to the postcolonial and post–World War II global organization of power and territory.[41] In their work on drone warfare and global media infrastructures, Lisa Parks and Caren Kaplan have further argued that these media infrastructures are "*biopolitical machines* that have the potential to alter life in a most material way." These machines are historically and culturally situated and emerge from histories of militarization and conquest that influence not only the forms of politics but also the strategies that emerge from these machines.[42] In similar fashion we understand smartness as emerging at a particular time and from particular histories, especially that of neoliberalism. We hope in this book to document, at least in limited ways, the many valences of smartness and the place of histories of empire and coloniality in structuring contemporary regimes of digital smartness.

As will be evident in this book, smartness is both an idea and an infrastructure. As Shannon Mattern argues, we must attend to "the hardware of media"; that is, we need to attend to the many materialities and histories of media infrastructure. This means understanding not only that digital media is specific and has its own forms but also that the overwhelming focus on questions of signals or communication in media studies sometimes comes at the cost of engaging different subjects and materialities. Similarly, to focus only on visible infrastructures, such as roads, or sewers, or fiber-optic cables, can come at the cost of recognizing the force of concepts, ideas, and imaginaries that enable and flow from them. Mattern develops the idea of media archaeology as literal engagement of digging up pasts as one resolution of this problem.[43] We develop a similar approach here by taking seriously the point that communications media have histories and shape territorial forms while at the same time attending just as seriously to issues of materiality (mining, extraction, algorithms) and the ideas that often predate, and encourage, the construction of smartness and the penetration of smartness into the environment.

Since we engage so many disciplines and trace these across a fairly lengthy time frame (roughly from the 1930s to the present), it will be helpful to note here that each of our chapters outlines a similar temporal rhythm. In each chapter a set of technical and theoretical tools first developed in the cybernetic sciences around and immediately after World War II was then reframed drastically in the 1970s (a period of global political turmoil but also increasing computational capacities). This reframing was then worked out more fully in the 1980s and 1990s and took on its contemporary form in the early 2000s, as computational speed and spread enabled what had once been only a dream—namely, environmental sensing and computing—to become a reality.

Chapter 1, "Smartness and Populations," begins with the theorization in the 1930s of what geneticist Ernst Mayr called *population logic* and a parallel emphasis on the importance of individual differences in economist Friedrich Hayek's theory of markets; the key innovation for both was to understand populations or markets as entities that learned, at least in a sense. These understandings of populations as sites of learning were brought into computational models of learning in the late 1950s and 1960s. This approach to learning was further cemented but given a decidedly market-oriented twist in the 1970s by distinguishing itself from a competing theory of the link between populations and computing instantiated in the famous report *The Limits to Growth*.[44] This report relied on the computer modeling of world systems but presented both markets and populations as dumb (i.e., incapable of learning). The market-oriented approach to learning populations was integrated in the early 1990s into a series of internet applications, such as the Google PageRank algorithm, and has since become a widespread principle of linking individuals by means of sensing and computing.

Chapter 2, "Demo or Die," takes up the territory of smartness (experimental zones) and employs the theory of "soft architecture" that Nicholas Negroponte developed in the 1970s as a key lens for understanding the link between experimentation and territory that is central to the zonal logic of the smartness mandate. We emphasize that Negroponte, who was based at the Massachusetts Institute of Technology (MIT), relied on approaches to computing first developed in post–World War II cybernetics discourse, which included Oliver Selfridge's "pandemonium" model of computer learning, Jay Forrester's systems approach to urban dynamics, and other MIT-linked attempts to model urban change. Negroponte's innovation was to apply these learning approaches to the *design* of urban infrastructure, with the goal of optimizing the learning capacities of the populations within cities. This approach subtly reframed the zoning principles upon which cities had been planned since the early twentieth century by focusing on transforming urban centers into sites of perpetual demos, or experimental zones.

Chapter 3, "Derivation, Optimization, and Smartness," explores the key means by which smartness produces learning from distributed populations—namely, by deriving value from what was earlier understood to be noise and waste. As in the case of chapter 2, we begin in the midpoint of our genealogy, the 1970s, focusing on the development of a new financial tool (the Black-Scholes option pricing equation) and underscoring the importance of noise and systemic connections for this technology. We note that although the Black-Scholes option pricing equation may seem esoteric and limited to finance, in fact it exemplifies a basic logic that is operative in a wide variety of contemporary technologies, including “platforms,” such as Uber and Airbnb; cognitive “mining” technologies; and population-level biobanks. We then trace the origins of this approach to noise and waste back to the post–World War II period, focusing especially on the psychologist Donald Hebb and the management theorist Herbert Simon.

Chapter 4, “Resilience,” focuses on the goal of smartness—namely, to enable resilience. Here, too, our genealogy begins in the period around World War II as the new discipline of ecosystem ecology developed a set of tools for understanding how natural environments respond to shocks from their outsides, such as radioactive fallout from nuclear bombs. Yet where ecosystem ecology still prioritized stability and homeostasis, ecologist Holling developed his concept of resilience in the 1970s as a way to center instability and perpetual change as the basic rule for ecosystems. Holling’s theory of resilience was intended to provide a model for managing ecosystems but quickly became a more general model of management itself. By the early 2000s, this model implied that management was first and foremost a matter of developing flexible systems that, through data-intensive but selective surveys of their environments, could quickly adjust to whatever new shock the environment might throw at them.

In our coda we contemplate the ways that ecology, economy, and technology have been reorganized through the mandate to make our world smart. In this final moment, we return to the Chilean Atacama to ruminate on how new forms of population-grounded perception and cognition might offer opportunities to make new worlds that are more just, equitable, and imaginative than those currently constrained through the limited comprehension of smartness often propagated by large-scale developers and technology industries.

SMARTNESS AND CRITIQUE

As we hope is clear from our account of the smartness mandate above, smartness is both a reality and an imaginary, and it is this commingling that underwrites both its logic and the magic of its popularity. Consequently, a critique of smartness cannot be simply a matter of revealing the inequities produced by its current instantiations. Critique is itself already central to smartness, in the sense that perpetual optimization requires perpetual dissatisfaction with the present and the premise that things can always be better. Therefore, the advocates of smartness can always plausibly claim (and likely also believe) that the *next* demo will be more inclusive, equitable, and just. A critique of smartness thus needs to confront directly the terrible, but necessary, complexity of thinking and acting within earthly scale—and even extraplanetary scale—technical systems.

On the one hand, this means stressing the ways in which the smartness mandate blunts what might otherwise be understood as the urgency of conditions of environmental degradation, inequality and injustice, mass extinctions, wars, and other forms of violence via the demand that we understand our present as a demo oriented toward the future and (as a consequence) by encouraging us to employ a single form of response—namely, increased penetration of computation into the environment—for all crises. On the other hand, it is impossible to deny not only the agency and transformative capacities of smart technical systems but also the deep appeal of this approach to managing an extraordinarily complex and ecologically fragile world. (And none of us is eager to abandon our cell phones or computers!) Moreover, the epistemology of partial truths, incomplete perspectives, and uncertainty with which Holling sought to critique capitalist understandings of environments and ecologies still holds a weak messianic potential for revising older modern forms of knowledge and for building new forms of affiliation, agency, and politics grounded in uncertainty, rather than objectivity and certainty, keeping us open to plural forms of life and thought. However, insofar as smartness separates critique from conscious, collective human reflection—that is, insofar as smartness seeks to steer communities algorithmically, in registers operating below consciousness and human discourse—critiquing smartness is in part a matter of excavating and rethinking each of its central concepts and practices (experimental zones, populations, optimization, and resilience) and the temporal logic that emerges from the particular way in which smartness combines these concepts and practices.