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## Epilogue: The Machinery of Urban Resilience

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**Abstract:** Cities are increasingly being recognized as sites of resilience, or as centres of life that will have to become more resilient in a world of intensifying hazard and risk. The literature on urban resilience tends to emphasize either the qualities of human cooperation and solidarity or those of the city’s intelligence capabilities—human or technological. This paper focuses, instead, on the city’s supply networks, arguing that the “machinic” qualities of mass provisioning and the flexibilities capacity of the city’s infrastructures may be key to the capacity of a city to mitigate against, or bounce back from, adversity.

**Keywords:** resilience; vulnerability; cities; infrastructures; slack; heterarchy

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Cities are intrinsically unstable entities: they suffer downturns, face unexpected events, and take some time to recover from crises (if that). They are large, open and dispersed. They gather life but also distribute it. They are full of variety, latency and multiplicity. They are territories but also nodes in multiple networks. They are constantly evolving, often in unpredictable ways and in new directions. Much of this change brings turbulence, uncertainty and insecurity. Yet, in the normal course of events, this instability does not cause cities to fall apart or descend into uncontrolled decline, and when things do go off course, recovery and readjustment swiftly follow. In the course of time, cities have endured all manner of difficulty, hedging against risk and bouncing back from adversity, small and large [1]. If cities are unstable, they are also in some ways resilient: while some cities have declined after suffering adversity, many others have managed to recover or stave off the worst, albeit by paying a price.

Maintaining this balance on the side of resilience rather than vulnerability is a key challenge of the 21st century for cities, not only because cities will house more and more of the world population, but also because the century is understood by experts and policymakers to be a time in which the perils of “risk society” as theorized by Ulrich Beck and others in the 1980s are likely to intensify. Anxieties are expressed about cities facing the extremes of climate change, the attacks of terrorists, militaries and

militias, and the disruptions of global pandemics, economic crises, mass migrations, and infrastructural failures [2]. The consequences are understood to be especially acute for cities, given their population densities and immense metabolic needs, their interconnected infrastructures, their strategic significance as sites of business, political and institutional power, and the high concentration of vulnerable people and places within them [3]. These features are seen to increase urban exposure to hazard, but also to contribute to risk through such consequences as excessive energy consumption and carbon emissions, the juxtaposition of immense wealth and power differentials, and stresses placed on urban infrastructures and services.

If this diagnosis is correct, cities will have to get better at anticipating, minimizing, and recovering from internal and externally imposed hazards and risks. Also, to be effective, they will have to find ways that work the balance between in-built tendencies of instability and honed practices of resilience. What this involves is an open question, for we know much more about what makes cities vulnerable than about how they stave off or bouncing back from adversity. The papers in this Special Issue fill an important gap in the knowledge by identifying factors derived from real examples of urban resilience. These include the significance of effective formal institutions, whose absence can lead to damaging jousts between competing communities, as Sonderhaus and Moss [4] show in their study of local water conflicts in Brandenburg, but whose presence is never neutral (as Hutter, Leibenath and Mattissek [5] reveal in their contribution on flood protection in Dresden). They include the role of shared stories, as shown by Fox Gotham and Campanella [6], in explaining recovery effort at neighbourhood level in New Orleans after Katrina. They include the skills and strategies of adaptation acquired by individuals, as Ibert and Schmidt [7] show in their study of the career paths of musicians, and the deliberate incorporation of ambiguity, uncertainty and slack by organizations in addressing volatile environments, as Grabher and Thiel [8] show for the London Olympics.

The studies identify important institutional and behavioural dispositions spread across professional and lay communities. But, in focusing on the qualities of key actors and affected communities, they tend to not say much about the qualities of the urban environment itself involved in mitigation, presumably because the city is seen as the sum of its actors. In this short contribution, I propose there is more within a city implicated in regulating the balance between vulnerability and resilience, in the form of gatherings of people, sociotechnical systems, built environments, and competences and capacities. I ask if there is something significant in the character and regulatory environment of the city as a complex system—which will differ in significant ways from one city to another. I suggest that as a site of multiplicity and diversity, the city is a machine directly involved—to varying degrees of success—in managing order and disorder and in shaping the responses of deliberating actors and institutions.

In the social science literature on urban resilience, we are beginning to see the rise of two quite distinctive narratives. One of them, typical to studies of urban crowds, unfolding disasters, or the survival strategies of the poor in the cities of the South, locates resilience in the altruism, inventiveness and fortitude of city dwellers in the face of adversity. The studies claim that extreme events bring out the best and not the worst among strangers who learn to pull together and help each other when the city is incapacitated, and that the urban poor tackle everyday hardships with fortitude as well as imaginative ways of making ends meet and finding opportunity [9–11]. The complexity of the city is broken down to its living communities, and resilience to the skills and capabilities of its inhabitants

(exemplified in this issue by Fox Gotham and Campanella [6] in the form of neighbourhood collaboration). The city, here, is the energy and variety of its diverse communities.

The second narrative, encapsulated by writing on “smart cities”, looks in the opposite direction, to ubiquitous technological intelligence and associated governance arrangements. Recognizing the plurality of the modern metropolis, and drawing on the example of cities investing in large-scale data capture, this narrative locates resilience—anticipatory and regenerative—in the capacity of city managers and sophisticated computational systems to work the vast quantities of information generated by the all-seeing city [12,13]. It assumes that the combination of sensors everywhere in the city (on bodies, infrastructures, buildings, machines, landscapes), non-linear modelling of the data, and fast and effective responsiveness to the intelligence accumulated, allows decision makers to know the city, anticipate likely developments, enable effective communication, and make informed decisions. Reviving the legacy of modernist urban planning, this narrative finds promise in the advances of science and technology [14]. The resilient city, here, is an association between smart technologies and smart people.

In placing the two narratives next to each other, it is easy to see that the first one tends to neglect the array of non-humans, including everyday tools and machines that prove to be crucial in any effort to fend off or recover from a hazard. It is also evident that it does not fully acknowledge that the poor, in facing daily existential adversity, are exhausted by the labour involved in coping with adversity, often without positive preventions and empowerments. It is also easy to see that the second narrative over-emphasizes the capabilities of smart machines and smart governance, at the expense of more prosaic forms of mitigation, including those identified by the first narrative. However, the question I find more interesting about the two narratives relates to the political work done by their propositions. By this I mean how they frame the “actionable space”, to elaborate Fox Gotham and Campanella’s [6] observations in this Special Issue regarding shared stories (see also Goldstein *et al.* [15] on the role of storytelling in riverside regeneration in Los Angeles and fire-fighting elsewhere in the U.S.) and Hutter, Leibenath and Mattissek’s [5] argument in this Special Issue that a discourse of resilience is as much about finding workable solutions, as it is about establishing a new governmentality of thought and practice.

Both narratives conjecture that a time of uncertain and hazardous futures has to be addressed through preparedness based on animated environments and animated subjects [16]. The resilient city—depending on local affordance—is imagined as the city of active citizens, intelligent technologies, and vigilant governance, a body on full alert. Any failure to mobilize hyper-vigilance in the form of anticipatory capability, continual surveillance, and entrepreneurial zeal, is seen as an abrogation of responsibility, an error of judgement [17]. The future is cast as very different from the past—more hazardous, more uncertain, and less predictable. Consequently, previous models of risk management are judged, wittingly or unwittingly, to be out of date, inappropriate. Chief among these, at least in the experience of the West, is a “duller” model of risk management entrusted in most social democracies to delegated institutions and infrastructures responding to an all-protections philosophy of mitigation. Here, the science and practice of dealing with risks—large and small—is incorporated into the machinery of social and urban maintenance, by building in slack and redundancy in the system of welfare and service provisions, ample spare capacity in the intelligence environment, and extensive insurance coverage, so as to ensure that dangers are anticipated, damage is minimized, and recovery is

fast. The silent provisions and hedging principles of this model of risk mitigation are somehow cast as slow and ineffective, placed against the hyperactivity of the model of revved up resilience [18].

Yet, to turn to my claim that the city is more than the sum of alert subjects and institutions, and that the character of the city as an assembly of infrastructures, institutions and capabilities may be implicated in the regulation of urban complexity [19], this passing over might amount to misrecognizing the essentially socio-technical nature of everyday risk mitigation in the city (as David Stark [20] notes in his contribution). In both technologically advanced cities and those in which people do most of the heavy lifting because infrastructures are deficient [21], working constantly in the silent background are the many bureaucracies, supply chains and metabolic systems that distribute the staples that enable agency (water, traffic, food, energy, information, know how, and more). There are also the collaborations between humans, tools, machines and intelligence systems that anticipate and tackle risks. There are many enterprises and organizations that specialize in insurance, security, emergency relief, recovery, and everyday maintenance and repair. Finally, there are the skills and technologies of network alignment and coordination that allow small reinforcements to amplify or large disruptions to be localized. The fine-grain quality and reach of these assemblies, along with their combined effectiveness, determines the city's capacity to withstand perturbations of various kinds, and the spread of the protective net across the city's diverse communities and neighbourhoods.

If urban resilience is a reflection of the robustness of the city's socio-technical systems—from the routines of traffic flow coordination and housing insurance, to the sophistications of non-linear modelling and large scale emergency planning—the smart city might turn out to be the one that succeeds in maintaining a well-oiled machinery of provisions and protections ticking away in the background. Such a city not only provides the revved up subjects and institutions the ballast they need to respond quickly and effectively to events, but also the functioning infrastructures and services, the metabolic and institutional variety, the modularized networks, the plural intelligences, and the copious spare capacity that make available an array of possibilities to meet the unforeseen and emergent development. There is emerging work that illustrates this for diverse cities responding to uncertainty and crisis [22,23]. This machinery of basic provisions and distributed intelligence does away with “just-in-time” responses to meet the presenting risk, opting instead for “backfill” of a less directed kind in order to prevent risks from escalating and hedge against the unanticipated by having alternatives in store. It ensures that attack on the frontline is backed up by reserves in the background, just-in-time by just-in-case.

Clearly, the city of unallocated reserves will not suffice in tackling specific emergencies that require focused attention and dedicated resource and expertise. It is no substitute for the revved up frontline. Yet, it covers the baseline of generalized protection and plural possibility in an environment of multiple relational networks and logics. Its core principles might also be appropriate for the frontline, as Grabher and Thiel [8] show in this Special Issue for the London Olympics, where risk was tackled—successfully—by deliberately introducing ambiguity, redundancy and loose coupling into the planning process. Dealing with radical uncertainty may require both the everyday city and the exceptional project to draw on the same principles of organization, albeit to different degrees of excitation. If this proves to be correct, narratives of war-like preparations involving vigilant subjects and vigilant environments will prove to have more to do with getting us used to the idea of a future held to be potentially apocalyptic, than with really securitizing life. The dullness of just-in-case

preparedness will need to be made to look more exciting and relevant, as will the sense of maintaining plural repertoires, as Ibert and Schmidt [7] find in their study in this Special Issue for mid-career survivors in the highly volatile musician labour market. In all this, questions concerning who benefits from the preparedness, which always has its own political economy and uneven distributions, remain, as do doubts about how far cities can be thought of as actors in a networked work in which power and authority lie elsewhere and in non-territorial networks. These qualifications, however, do not blunt the argument that if capabilities to secure the wellbeing of the many are to be developed within cities, they should focus on particular kinds of intervention.

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### Conflicts of Interest

The author declares no conflict of interest.

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