An Endless Flow of
Machines to Serve the City:
Infrastructural Assemblages and the
Quest for the Metropolis

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But the principle behind all technology is to demonstrate that a technical element remains abstract, entirely undetermined, as long as one does not relate it to an assemblage it presupposes.

—GILLES DELEUZE AND FÉLIX GUATTARI

In October 2008, when tourists and residents of Dubai City left their newly constructed luxury hotels or apartment complexes and headed down for the emirate’s fabled beaches, they were confronted with a disturbing scene: miles of shoreline covered with the stinking contents of septic tanks. Although Dubai is one of the most developed settlements in the world and has one of the fastest and most advanced high-speed digital communication networks, it has no public sewage system to speak of. Instead of sewage flowing through pipes to a treatment plant within the city, thousands of trucks with filled septic tanks leave the city every day. They head for the desert to Dubai’s only overcrowded treatment plant, resulting in miles of queues and more than ten hours waiting per load.

cycle. Drivers, paid by the load, are thus highly tempted to drop their cargo somewhere in the desert, or dump it down a stormwater drain where it eventually ends up on the cities beaches.

Besides threatening to damage Dubai’s image as a successful model of ultra-modern, capitalist urban development in the dawn of the twenty-first century, this phenomenon also reveals a paradox. Dubai can build the world’s tallest tower and transform a desert into a vast agglomeration of extensive residential settlements and luxury hotels—tying up a lot of the region’s surplus capital. It has, however, not constructed the public sewer works it needs, resulting in unhygienic and hazardous conditions and massive costs of rectification for the public sector. How, one might ask, could this have happened? If urban planners did not simply forget to implement these infrastructures, what else was going on here? In trying to approach this question, we have to examine the historical dynamics of both infrastructural development and the way these systems have been theorized in disciplines like urban planning and urban studies.

First and foremost, the case of Dubai highlights not only the new modes of how the public sector is retreating from urban development. It also demonstrates a willful ignorance of the classic premise of urban planning concerning the importance of urban infrastructure. As taught to legions of urban planning students, water supply and sewer systems are the bottom of the pyramid and provide the basis for settlement. Mirroring the spatial configuration of a classically planned city, above the sewage system lies the transportation network (for instance roads or railways) and finally, on top of this lies electric lines, gas pipes, and high-speed communication lines.3

This rule apparently does not hold true anymore—neither in the rapidly expanding contemporary cities of the Global South nor in the metropolises of the Western world. All over the globe and mostly away from the public eye, the crisis of the functionality and role of infrastructure deepens. In the fastest growing megacities of developing countries, infrastructure systems only exist in older, more established parts of the megacities, as well as in the enclaves and citadels of the privileged. Their slums and shantytowns almost never possess a working infrastructure—like access to fresh water or waste disposal—resulting in catastrophic living conditions.4 In the Western metropolises like Paris, London, or New York, the ailing underground tubes and pipes installed many decades ago are decaying and cause countless, and sometimes quite spectacular, malfunctions. One example is the 2003 explosion of an eighty-year-old gas pipe close to New York’s Grand Central Terminal, which emitted a force so strong that heavy iron manholes shot up several meters in the air.5 Perceived as a symptom of the catastrophic conditions of the outdated and poorly maintained infrastructure systems in Western metropolises, it led urban scholars to see it as yet another piece of evidence of a “global crisis of the city.”6

Despite being widely marginalized or neglected in both urban politics as well as urban studies, events like these recently generated interest in the material components of the urban fabric. Moreover, alongside shifting our focus to urban infrastructure, scholars might also be able to rethink a broader range of issues related to the city and its role in structuring everyday practices. In this text, I put forward an understanding of cities, and especially of metropolises, as complex, dense, and heterogeneous agglomerations of infrastructure that have a highly constitutive force on the practices of its populations.

In unfolding this argument and addressing some of the key roles of urban infrastructures, this essay will proceed in several steps. I first shortly sketch how the machinic aspects of the social have been framed (or neglected) in social and cultural studies in the past. Second, after summing up recent approaches in theorizing material elements of the city, I suggest conceptualizing infrastructures as machinic assemblages in the sense of Gilles Deleuze/Félix Guattari and Manuel De Landa. Third, I discuss how infrastructural assemblages establish complex regimes that link them to urban nature, politics, economics, and social formations and that briefly connect them to the rather recent development of “mobile digitalization.” Finally, my concluding remarks outline how addressing urban infrastructures can provide key impulses for urban studies in general and particularly regarding the question of what the terms metropolis and metropolitanism might refer to. Given the complexity of the subject as well as the various theories for approaching them, these thoughts can only be laid out here in a rather cursory and fragmentary way. Despite having to simplify many aspects, I nevertheless aim to emphasize the potential of researching infrastructures and to highlight some of the groundbreaking studies that have been undertaken in recent years.

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4 Mike Davis, Planet of Slums (New York: 2007).
6 Ibid. My translation.
I. THE NEGLECT OF INFRASTRUCTURE IN URBAN THEORY

Classical perspectives in disciplines like sociology, history, or cultural studies lack a strong theoretical and methodological approach to address the role of infrastructure in the urban sphere—a circumstance perpetuated in the field of urban studies. The problems already start with the history of the term infrastructure itself. As the German historian Dirk van Laak points out, the concept originally derives from the era of the implementation of the railways in the nineteenth century. First seen in France in 1875, it was used to describe railroad beds and later also for other immobile components that allowed mobility. Only from 1950 onwards was it used by the North Atlantic Treaty Organization (NATO) in the context of military logistics and economic integration and later expanded into discourses in the field of development aid. It eventually became part of the vocabulary of political economy and therefore found application in the respective academic fields of economics, political studies, and urban planning.

However, the term is more imprecise and ambiguous than it may seem. For example, in many cases it is pretty difficult to actually distinguish “urban architecture” and “infrastructure.” Moreover it sometimes also refers to social services like hospitals and schools, while in other cases the term “symbolic infrastructures” is applied to memorials or museums. Therefore, as the economist Walter Buhr wearily states, no comprehensive definition of the term can be given. For the purpose of my subsequent remarks, I will start from the definition given by Christopher G. Boone and Ali Modarres: “We define urban infrastructure as the network of services (other than public buildings) that allows the circulation of people, materials, and information within the city.”

Regardless of the obvious importance of infrastructure for the urban condition emphasized in this definition, it is at least remarkable that, for nearly a century, infrastructure remained rather peripheral in urban theory. It seems that the functionality of infrastructures appeared wholly commonsensical and anything but problematic to most urban scholars. Moreover, addressing their role in shaping the city was not perceived as necessary in order to gain a better understanding of urban sociability. The increasing orientation toward the sociocultural phenomena of deconstruction and representation along with the rise of the cultural turn in the past decades of the twentieth century helped especially to foster an anti-technical bias that had already accompanied the social and cultural studies since their formation in the decades around 1900. Texts by Karl Marx, Georg Simmel, and Max Weber, for example, show a bias toward what the German theorist Wolfgang Eßbach called an “anti-technical attitude” that tends to neglect or at least to downplay the role of artifacts in the social sphere. Why did these classic scholars insist that infrastructures and other artifacts were less significant for understanding urbanity than asking questions such as how and to what extent is urban space illuminated at night or which segments of the urban population have access to water, electricity, or transportation?

Following Eßbach’s arguments, this marginalization of the built environment in the theoretical groundwork of the discipline had multiple reasons. The experience of an expanding mechanization and aestheticization of life around 1900, especially in the growing metropolises of the Western world, was perceived as potentially unsettling to the nascent discipline of sociology. In the sociological classics, society emerges out of the horizon of religion, which was the early form of sociability and believed to be constitutive for explaining its contemporary forms. In emphasizing concepts like “culture,” “meaning,” and “social systems,” early sociologists aimed to establish their own methodological approach toward modern society in competition with alternative worldviews, for example, with the emerging fields of engineering and aesthetics. In most cases, foundational sociological texts evince a general mistrust and suspicion toward the role of objects and machines that culminated in concepts like “reification” or “commodity.” This set the course very early on not only for the social and cultural studies in general, but also for their attempts to explain the forms of social organization in the metropolises of the West. When addressing architectural or infrastructural forms, if at all, it was under the premise of their character of expressing, manifesting, or representing the social, in short, as social realities of a subordinated order.

On the contrary, I argue that instead of analyzing these systems under their symbolic moments of how society expresses its inequalities and social stratifications in infrastructures, we rather have to understand them as the very mode of operation of the social itself. Therefore, in attempts to focus on how infrastructure creates, forms, and maintains sociability, we need to rely on other (and maybe newer) concepts. If, for example, we conceptualize infrastructures as a constitutive “media of integration” as Dirk van Laak proposes, new and potentially fruitful perspectives on the material components of the metropolis can be opened up that go beyond granting them a subordinate status in the social realm.

II. SOCIO-MACHINIC ASSEMBLAGES AND THE URBAN CONDITION

In recent years, the role of infrastructures in urban studies has been subject to an increasing interest—a phenomenon not the least of all due to events that drew the alleged plausibility and implicitness of how infrastructural systems seem to work into question, as the example of Dubai illustrates. Exemplifying the assumption that things only enter public discourses when they become increasingly questionable and problematic, and traditional modes of framing them no longer seem to be adequate, metropolitan infrastructures became a focus of urban scholars from a wide array of perspectives. These include questions of how infrastructures help to discipline, exclude, or include certain parts of urban population; how they are becoming increasingly militarized and privatized; and in what way they participate in creating or modifying a public realm or our understanding of nature. Moreover, there seems to be a growing interest in how and to what extent these systems shape urban practices, bodies, and “structures of feeling,” as well as modes of perception and subjectivity—issues I will discuss more extensively below.

This new interest is fueled by a massive reconsideration of the role of materiality in the social and cultural sphere—most prominently addressed in the writings of the French philosopher Bruno Latour and actor-network theory (ANT). Although ANT recently became highly influential in social and cultural studies, in the realm of urban studies, it is still widely neglected. Nevertheless, the 2010 publication of the volume Urban Assemblages: How Actor-Network Theory Changes Urban Studies, edited by Ignacio Farías and Thomas Bender, has shown how promising this perspective is for addressing the interrelations between the urban condition and its materialities. One of the core assumptions is the concept of symmetry, meaning an equal treatment of both human and non-human actors in its theoretical approach toward urban phenomena. In the following, I will draw on these findings while also proposing an understanding of infrastructure that takes a slightly different angle: that of assemblage theory.

While many assumptions of ANT derive from the concept of assemblage that was originally developed by Gilles Deleuze and Félix Guattari, ANT quickly became a methodology in its own right. In expanding and altering many of its basic hypotheses, predominantly to better theoretically frame how knowledge is produced in laboratory situations, it also abandoned many original key elements. I aim to show that understanding metropolitan infrastructures as socio-technical assemblages in the original meaning of Deleuze/Guattari provides a useful framework for addressing the multifaceted impact they have on the urban everyday. Moreover, assemblage theory also follows the imperative of symmetry and intersects at a number of points with ANT and with the work of Farías and Logistic Space, U.S. Port Cities and the ‘War on Terror,’” in Disrupted Cities: When Infrastructure Fails, ed. Stephen Graham (New York: 2010), 69–84.


What are assemblages? First and foremost, assemblages are a contingent collection of very heterogeneous elements. They can bring together, for example, artifacts, symbols, discourses, bodies, nature, and politics—all elements that are normally separated in academic research. These assemblages are of course not arbitrary. They always produce and create something new. As J. Wise states, “We don’t know what an assemblage is until we find out what it can do, that is how it functions.” Moreover, assemblages are characterized by their ability to form a territory as well as by having an expressive element that forms their identity. The assemblages’ territories, however, should not so much be understood as a simple physical space, but rather as a set of space-related practices—acts that need to be actualized and institutionalized to become durable and unfold their power.

Therefore, assemblages themselves are not so much static entities than they are processes. They are temporary and can change or dissolve. Elements can disconnect or become part of other assemblages, altering the functionality of the original assemblage. In short, they are always subject to a specific historical dynamic. This is conceptualized in the two main dynamics of assemblages: the way they territorialize or deterritorialize, as well as their processes of coding and decoding in discourses, bureaucracies, or jurisdictional frameworks. These dynamics bind the technical machines of the assemblage to its other parts, thereby allowing the assemblage to work. To quote Deleuze/Guattari: “It is the machine that is primary in relation to the technical element, not the technical machine, itself a collection of elements, but the social or collective machine, the machinic assemblage that determines what is a technical element at a given moment, what is its usage, extension, comprehension, etc.”

If we follow this approach, this means that urban infrastructures are not things that can be isolated from their contexts—their specific territories, practices, and discourses. Instead, they are interwoven into a complex net of people, politics, and other infrastructures. The philosopher Manuel De Landa, one of the very few theorists who aims at introducing assemblage theory into social studies, states: “Social entities like cities, for example, composed of entire populations of persons, networks and organizations, can hardly be conceptualized without a physical infrastructure of buildings, streets and various conducts for the circulation of matter and energy, defined in part by their spatial relations to one another.”

It is this relational quality of infrastructural assemblages and their ability of establishing and interweaving territories that to a large extent constitutes the spatial dimension of the metropolis. While many urban infrastructures do not have geography in a classical sense, they nevertheless establish and homogenize territories while producing specific ranges of coverage. Think for example of infrastructures of wireless communication or urban transit. Moreover, if, as Dirk van Laak claims, infrastructures are media of integration, we have to understand that this concept of integration is twofold. On the one side, urban populations are integrated or excluded within the metropolis via machinic assemblages. On the other side, people integrate infrastructures into urban fabrics via practices and tie them to other infrastructures. This is realized in many ways, like via artifacts, body techniques, laws, rules, discourses, and perceptions. Therefore, it becomes apparent that we need to expand the scope of what the term infrastructure refers to. In light of assemblage theory (as well as ANT), the “networks of services” that Boone and Modarres define as infrastructures have to include more than its pure material elements of cables, tubes, or fibers. They must also take into account the discourses, bureaucracies, territories, subjects, and practices that are interwoven with them. All of these elements form an infrastructural assemblage.

Keeping this in mind, if we want to understand what a metropolis is (or what it can do), it leads us on a wrong track to understand infrastructures as merely having some sort of impact, thereby rendering infrastructures as external and separate to the metropolis itself. Despite the etymology of the term, we have to understand the vast “meshworks” of infrastructural assemblages not just as the basis or foundation of a metropolis but also as what actually constitutes it. As urban machineries inform every fabric of the metropolis, they also structure nearly every cultural practice of its population, from the moment we get up, eat, wash, and go to work until we set the alarm clock at night. They shape our habits and economics of work and leisure, our perceptions and bodies, and our affects and desire. They shape the way we realize friendships and family and the way we realize love relations and sexuality.

22 Deleuze and Guattari, A Thousand Plateaus, 398.
24 Ibid.
Understanding cities as populations of assemblages means that we also have to decenter the object of urban studies and to dismiss the idea that we are dealing with a coherent, well-defined entity. A metropolis is not a coherent object but a specific population of promiscuous assemblages, thus constantly in the mode of becoming. Each metropolis consists of a specific group of large, dense, and heterogeneous mechanospheres. Or as Ash Amin and Nigel Thrift put it: "A set of constantly evolving systems or networks, machinic assemblages which intermix categories like the biological, technical, social, economic, and so on, with the boundaries of meaning and practice between the categories always shifting." Understanding infrastructures in this way might not only offer a new historical perspective on infrastructure, what Dirk van Laak coined as "infrastructural history," but also open up a wider field of urban infrastructuralism that could enrich narratives of the geneeses and sociocultural dynamics of what we call metropoles.

III. ELEMENTS OF URBAN INFRASTRUCTURAL ASSEMBLAGES

In order to unravel these multifaceted entanglements constituted in urban infrastructural assemblages, I will first address some key aspects for understanding how they compose what we call a metropolis—the way they entangle nature, politics, social order, and the bodies of its populations as well as their fragility. As I will subsequently demonstrate in the case of mobile digitalization, all of these aspects are vital in how urban assemblages unfold.

Nature

From an anthropological and environmental perspective, urban infrastructural assemblages serve as a mediator that relates to both nature and culture in a city. This mediation, however, is far from well balanced: "Infrastructure makes life possible in cities, but at costs to the natural environment." In their function of relieving the population from many burdens, infrastructures allow on the one hand for a mode of abstraction and leveling of environmental influences and differences as well as social relations. This function as mediator, on the other hand, brings about new constraints and dependencies. The implementation of infrastructure so radically changed our relations to nature that it seems increasingly implausible to understand infrastructure as a realm outside of culture or the social.

This becomes especially obvious when we look deeper into urban disasters that have been predominantly framed as natural: from the fires that burned down large parts of San Francisco on the morning of April 18, 1906 after an earthquake disrupted many gas lines to the 2005 flooding of New Orleans after Hurricane Katrina, which was mainly caused by an infrastructural failure of the levees. Attributing these incidents solely to natural causes seems to miss the point. Nature, and especially nature in cities, is anything but separable from or even outside of its social, cultural, and economic realms. Instead, we have to perceive nature and its resources, like many other aspects, as part of infrastructural assemblages and therefore as part of the social. As historian Dorothee Brantz has emphasized, this holds especially true for large cities, which should rather be understood as an "integrated realm where natural and built environments interact to create a space of symbiosis rather than difference, where nature is integrated rather than emptied out." This integration, one might add, was already achieved in its modern form in the nineteenth century via establishing large technological systems that allowed for new forms and dimensions of connectivity and symbiosis of nature and built environment.

Especially since this time, emergent technologies became a part of many metropolitan assemblages, drastically transforming their territories and codes at a record-breaking pace. While elevators lifted cities upward, increasing density as buildings became taller, public transportation pushed cities outwards, causing

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25 Farías and Bender, Urban Assemblages.
26 Ash Amin and Nigel Thrift, Cities: Reimagining the Urban (Cambridge: 2002), 78.
27 Boone and Modarres, City and Environment, 95.

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urban sprawl and the beginning of suburbanization. Especially around 1900, people in metropolises like Paris, London, New York, Boston, and Berlin witnessed unprecedented activity that perforated their soils and tore open their streets to implement massive infrastructural networks. With the installations of technical assemblages and machineries like canalization systems and underground transit, they became the most thoroughly engineered spatial agglomerations in the history of mankind. This development not only attempted to successfully relate nature, technology, and culture, it also required the development of a specific set of political practices—ways of governing not over but through the infrastructures of the emerging machinic metropolis.  

**Politics and Power**

Of course, metropolitan infrastructural assemblages have always been a key device in including and excluding urban populations. As their assemblages unfold, the material elements of infrastructure are intrinsically connected to public discourses and political regulations. Focusing on these connections allows us to see how these machineries incorporate political ideologies, or, to paraphrase Tom Bender, that there are Democratic and Republican sewer systems. Throughout history, the realization of infrastructural projects has also been tied to the evolution of territorial power: from aqueducts and transportation networks in the early metropolises of Babylon and Byzantium to contemporary mega-projects of urban renewal like Navi Mumbai in India, the world's largest planned city.

In the twentieth century, infrastructures have become the main governmental assets besides social and military investments. Especially between World War I and the 1970s, infrastructural implementation and improvement was a central concern of governmental actors in both Europe and North America who were attempting to realize the modern ideal to standardize, integrate, and monopolize urban infrastructures. In the nineteenth century, these technologies already started to become sociopolitical devices that inserted themselves in between the sovereign and the everyday person and subsequently became part of both. The governmental strategy of addressing social questions via infrastructural implementations and thereby framing them under the premises of social engineering was enforced and differentiated since the beginning of twentieth century, despite changing political regimes.

Especially in European metropolises, the ideology of realizing the "provisions for existence" (Daseinsfürsorge) became hegemonic in this era. This ideology aimed not only to pacify the working classes but also to assure the preservation and fostering of a productive work force with consumer power in a Fordist economy. That this top-down infrastructural integration not only tended to establish monopolies but also to incorporate everybody becomes especially apparent through a German law, enacted in the early twentieth century, which mandated that every citizen must be affiliated with infrastructural services (Anschluss- und Benutzungszwang). Even today, it dictates the legal compulsion of being connected to networks of water supply, sewage, waste management, and community heating, thereby establishing a territorial infrastructural regime that reveals a strong utilitarian ideology.

However, the late 1970s, in many aspects a crucial turning point in this development, led to a reconsideration of the state role in infrastructural provisions. This was mainly caused by growing financial problems, deindustrialization, and the reorganization of the economy toward flexibilization, the pluralization of consumerism, and the rise of the tertiary sector (aspects usually subsumed under the label of a "post-Fordist urban economy"). Together with a rising awareness of environmental concerns as well as of the limits of growth and resources, this new economic model brought about a retreat of the state in many fields, including in the provision of metropolitan infrastructures. In many cases, this was enforced by a financial crisis or the bankruptcy of Western metropolitan governments. Subsequently, private investors, who until this point had mainly been contractors and agents in realizing urban infrastructural projects under governmental regulations, were increasingly emancipated from this role. As (neo)liberal forces gained momentum, mistrust grew toward state-subsidized infrastructural developments with their intended or tolerated monopolistic structures under the suspicion of distorting competition and hindering growth. Through processes of deregulation and liberalization, the private sector became the driving force of urban infrastructural development. By pursuing their own agendas of profit maximization, in many aspects this new regime was contra-

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31 See Thomas Bender, "History, Theory and the Metropolis," in this volume.
33 van Laak, "Infra-Strukturgeschichte.”
dictory to the governmental ideal of providing basic services to its population, as the example of Dubai City vividly shows. As Stephen Graham and Simon Marvin argue in their groundbreaking book *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*, this resulted in a collapse of the integrative ideal of networked urban infrastructures, with manifold consequences.

Here, I can only cursorily outline some of the key findings of this rich and essential study. Following Graham and Marvin, the crisis of urban infrastructure and the withdrawal of network cross-subsidies around the 1970s resulted in the enforced physical decentralization of the fabrics of Western metropolises, forming poly-nucleated structures and unbundling urban landscapes. This *splintering* became manifest in secessionary networked spaces and new socio-spatial divides like fortress spaces and hyper-ghettos, emphasizing not only the political but also social efficacy of infrastructures.

### Social Order

In his 1986 essay *“Do Artifacts Have Politics?”*, Langdon Winner states that while we tend to think of infrastructures as neutral tools, their political function is inherent insofar as they always produce, maintain, or alter specific social orders. Examples of how infrastructural arrangements have political effects of maintaining the status quo in urban regimes can be found throughout history. Just to point some out, in the middle of the nineteenth century, when Baron Georges-Eugène Haussmann restructured Paris, one of the main reasons for implementing the broad thoroughfares and boulevards was to prevent any recurrence of street fighting and the building of barricades that had occurred during the revolution of 1848. This strategy of constructing huge spaces and plazas in city centers to defuse civil uprisings also has many examples in the metropolises of the twentieth century: from Moscow and Mexico City to the vast North American university campuses reordered after the uprisings around 1968. Another example is the racial segregation in South Africa and the United States, where non-whites were denied not only civil rights like voting, but also equal access to infrastructural services like public transportation and water supply. During this time, seating in public transportation or drinking fountains permanently actualized racial discrimination in the urban every day, manifesting and enmeshing both infrastructural and social order.

In forming assemblages, infrastructures and social regulations mutually construct and maintain each other. This process, however, in many ways results in unforeseen effects. Thus, infrastructural politics are not simply a political ideology cast in concrete and steel but produce rather hidden consequences not intended in the first place, while nevertheless being highly influential. A good example is the highly gendered construction of urban infrastructural networks, especially in mobility regimes. As Graham and Marvin point out: “Because much of the public transport laid out by modern infrastructural planning was designed around the needs of full-time, largely male, workers commuting to a city centre, services rarely met women’s needs, limiting them to a more spatially restricted job market.” Not only did and do women generally have far more limited access to cars but their multiple roles and duties often meant (mean) that they also had (have) shorter and multipurpose mobility patterns. Thus, many had to use off-peak and unreliable public transportation, an often exhausting and resource-consuming struggle. In countless other ways, the implicit masculine bias of these assemblages reinforced the social position and status of women in Western metropolises.

These examples illustrate how infrastructural assemblages realize core functions of social organization and stratification as they divide, distribute, and collect social spheres. In doing this, they not only organize social stratification, determine the inside and outside of the social, and manifest public and private realms, but also establish and maintain subject formations. Conflicts over who has access to which infrastructures and under what circumstances have always been crucial in the dynamics of metropolitan development. The responses to these conflicts, however, have historically varied greatly. In short, especially since the late twentieth century, we can diagnose a trend toward individualization of access. Despite the fact that ascriptions of nationality and origin are still crucial or sometimes even enforced, the individual recourses of social, cultural, and especially economic capital become increasingly decisive. Along this line, to renounce the usage of specific infrastructures becomes an attribute of social distinction in a truly Bourdieuan sense, examples of this being the refusal of drinking public tap water or using mobile and Internet-based communication and services in the 1990s. Furthermore, the use of public transportation in most areas

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36 Winner, “Do Artifacts have Politics?”


of the US is highly stigmatized as a signifier for belonging to the lower classes. Adopting Loïc Wacquant’s concept of territorial stigmatization, one could frame such phenomena as infrastructural stigmatization. This demonstrates how assemblages of infrastructures enforce codes and territories aligned with specific subject formations along lines of race, gender, or class, especially in metropolitan contexts.

**Bodies**

In composing and framing specific subject formations, infrastructures also interpellate and structure the bodily practices of the urban population. This becomes especially apparent when considering the immense impact of the sewer systems on the everyday life of those inhabiting Western metropolises like Paris, London, or New York in the nineteenth century. Sewers implemented a new self-awareness of the body alongside a new hygienic regime, as well as massively changed concepts of public and private space and its usages, as Donald Reid has shown. From this point on, the cleaning and display of the exposed body was assigned to private spaces instead of public baths. Also sewer systems altered structures and affects of sexuality and shame and led to new perceptions of purity and disgust, rendering primary bodily functions as something to be hidden. If they suddenly return to public visibility, for example on a Dubai beach, they provoke massive nausea, revealing the disciplinary powers of infrastructural assemblages.

Another example of this is the exclusion of ill or abnormal bodies in urban public transportation. Even though recently some transit systems are making efforts to include blind and deaf people or people in wheelchairs, they nevertheless aim to categorize and rationalize passengers’ bodies as they regulate movements and perceptions in their goal of creating an easily controllable environment that makes certain practices impossible. Moreover, it seems that all infrastructural assemblages, be it networks of water supply, transportation, or digital communication, also contain a concept of *infection*, a threat commonly addressed through the exclusion of abnormal and suspicious elements. Infrastructural assemblages shape bodies and bodily practice, and vice versa. One example, given in a recent study by Simon Marvin and Will Medd, shows how many contemporary metropolitan sewer systems face a new and until now widely disregarded problem. With the increasingly obese bodies of urban spaces, sewer systems are increasingly clogged by discarded fat. While this sounds like a banal and marginal phenomenon, it will cause massive and severe difficulties in the future. It also points to an aspect that has not yet been addressed in this essay that is of key importance in the understanding of metropolitan infrastructures: their fragility.

**Disruption, Fragility, and Subversion**

Up to this point, I have mainly sketched out how infrastructural assemblages territorialize and codify the metropolis in consolidating its natural elements, political hegemonies, economics, and social orders, as well as the everyday subjectivities and bodily practices of its dwellers. Yet, this is just one side of the coin. Constituting assemblages, infrastructures have to be understood as dynamic processes rather than as static entities. As such, they not only establish themselves along the axes of territorialization and codification, but also alter or even dissolve as their elements become recoded or deterritorialized. It is these processes of destabilization—like failure, temporary appropriation, and attacks—that are central to the question of what infrastructural assemblages can do.

Most urban infrastructures constitute networks of mostly enormous proportions with complex economic, political, and bureaucratic systems attached and can therefore be characterized as what Thomas P. Hughes calls “large technological systems” (LTS). As such, they tend to stabilize their functionality and adapt to new situations rather slowly. After having a prominent role in public discourse during their implementation, they moreover tend to become invisible and black-boxed. While some infrastructures become iconic symbols of power or technological achievement, in most cases, users are not conscious of the complex logistics and technological processes that allow these systems to function and that make their everyday routines possible. Following Hughes, once these assemblages are established and their functionality becomes unambiguous; they are perceived as normalized and natural at least for those who are allowed to use

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40 Reid, *Paris Sewer and Sewermen*. See also ibid.
them. Only when they break down or become dysfunctional do they reappear in political discourse.44

The perspective on how infrastructural assemblages are disrupted reveal some of their core characteristics, as the most recently published edited volume by Stephen Graham entitled Disrupted Cities: When Infrastructure Fails (2010) also shows.45 Despite demonstrating the conditions and effects of infrastructural failure such as blackouts, however, to what extent infrastructural assemblages undergo deterritorialization and decoding differs widely. They can be "hacked" or altered without losing their capability to circulate information, people, or goods. Furthermore, there are also the countless little appropriations of infrastructural technology, from fare beating, water tapping, and graffiti to digital file sharing and illegal parking. While they do not leading to a complete breakdown, they nevertheless create permanent dynamics and flux of infrastructural assemblages. These conflicts allow for the constant modification and renegotiation of the accessibility and use of the systems. As cunning tactics in the sense of Michel De Certeau,46 they look for the blind spots of socio-technical regimes to implement or alter codes while aiming to establish their own temporal territories, thus provoking strategic reactions from its operators.

This especially holds true for the subversive practices of a rather more political kind. The disciplinary function of infrastructures frequently makes them an aim of civil disobedience, especially in an urban context. Besides politically motivated iconoclasm or vandalism (for example of closed-circuit television systems), metropolitan infrastructures have been a frequent aim of terrorist attacks, as on the subway systems of Tokyo (1995), London (2005), or most recently Moscow (2010). During war times, they are also often the preferred

targets of military action or become militarized, as highways serve as landing strips or subway stations become transformed into bunkers. Especially in the last decade, under what has being coined as the "war on terror," urban infrastructures have become increasingly militarized through implementing new digital surveillance techniques.47 Following Deborah Cohen, to implement these new security regimes, urban hegemonies widely build on fears and anxieties of infrastructural breakdown.48 As mentioned above, these assemblages are not only fragile in regard to their social, political, and cultural dimensions, but also in their relation to their "natural" environment and their dependence on other infrastructures. Alan Weisman reminds us that without the power supply that keeps the 753 water pumps in Manhattan's underground running, half an hour of rain would be enough to flood its subway system to such an extent that it would break down.49 The intense interweaving of contemporary metropolitan infrastructural assemblages means that the disruption of one system most likely results in "cascading failure,"50 thus multiplying damage.

Urban Assemblages of Mobile Digitalization

Having sketched out these aspects of infrastructural assemblages and their historical dynamics, I briefly want to highlight one recent development that is becoming increasingly powerful in the context of metropolitan life and that exemplifies the intertwining character of infrastructures: mobile digitalization. In the past years, the rise of digital networks has become a highly challenging and influential device in the urban everyday. Already over four decades old, digital networks are far from being such a new technology. On the level of the individ-

44 What might be underexposed by Hughes here, is that in daily life, people actually seem to talk a lot about infrastructure, especially in urban settings. From traffic announcements on the radio to complaints about slow Internet connections are, poor mobile reception or the subway being delayed or overcrowded. This everyday talk, and while not exactly establishing a critical discourse on the political or social implications of infrastructure, it nevertheless serves an important purpose. In constantly normalizing the defects and little irregularities of the machinic environment, these utterances can be understood as a form of maintenance or repair in the sense of Erving Goffman. They serve the purpose of sense making, as we constantly reassure ourselves of the world around us, thus stabilizing it. See: Erving Goffman, The Presentation of Self in Everyday Life (New York: 1959).
45 Graham, Disrupted Cities.
48 Cohen, "Containing Insecurity." Moreover, the anticipation of the collapse of metropolitan infrastructures is also a central element of the imaginary of its dwellers. It is acted out in countless products of the cultural industry, like in the famous Die Hard film series. It is also manifested in urban myths and phantasms, from the monstrous alligators in New York City's sewer system to the government's insertion of mind-altering drugs in public water. See: Williams, Notes on the Underlground.
ual consumer, however, the socio-technical assemblages that unfold around it are rather recent and still in full force. Just like the Western metropoliases have become mechanic in the past century, they are becoming increasingly digitalized.

Of course, digital networks have already begun to radically transform urban fabrics in the past decades, as for example allowing for the emergence of home offices that in many ways have decentralized urban agglomerations and produced what Robert Fishman calls “technoburbs.”\(^5\) As variations of “edge cities,”\(^5\) “technoburbs” refers to the growing slice of suburbia centered around high-tech industrial parks and nearby retail malls, as well as cultural, entertainment, and educational complexes that compound problems of citizen detachment and a sense of anti-urbanism. The implementation of these digital infrastructures in many ways did not, however, result in the forming of assemblages that led to the end of dense urban agglomerations, as many urban scholars predicted over the last decades. Instead, they seem to be highly compatible with existing metropolitan networks, enforcing the already-strong network character of contemporary metropoliases.\(^3\) Many infrastructural assemblages aim to accelerate their flows and rhythms—be it in the realm of transportation, information, or communication. The focal point of this development is the establishment of real time, a characteristic almost intrinsic to digital networks, especially when their access becomes mobile. In the near future, digital technologies like portable devises, social networks, and augmented reality will have an even stronger impact on our perception and understanding of the metropolis. As these technologies are incorporated into new assemblages that form new codes and territories, new forms of exclusion and inclusion as well as urban practices unfold. Many of these new practices are altering and marginalizing classic urban cultural techniques and modes of perception, like for example Walter Benjamin’s famous art of getting lost. A portable GPS will put an end to the classical idea of the metropolis as a labyrinth.

The new subject types that manifest in these digital assemblages are theorized under what urban scholars have coined “cyborg urbanization.”\(^4\) Like all infrastructural implementations, they both hold specific groups of urbanites from many burdens and constraints, while also doubtlessly enabling unaccus-

tomed forms of hegemony and dependence. In the ongoing push toward the mobilization and an unbroken connection to digital networks, new forms of controlling and disciplining urban populations are being established. Already it is becoming more and more difficult and subversive to be offline and off the grid, therefore provoking new insurgency tactics and forms of resistance. Access to these technologies is not only class related and serves a mode of distinction, as “the very lifeblood of digital capitalism,”\(^5\) it also enables new economic regimes that bring about advanced forms in the capitalist logics of exclusion and exploitation.

IV. TOWARD AN UNDERSTANDING OF URBAN INFRASTRUCTURALISM

Having highlighted some of the multiple relations and the historical dynamic of metropolitan infrastructural assemblages, I hope to have shown the importance of this perspective in the task of understanding what a metropolis is and that studying these aspects is far from dull and boring. Instead, they provide a promising vantage point to address the very core of urban conditions. In the following, I want to point out some consequences for the theoretical framing of these phenomena for the field of urban studies.

First of all, we must reconsider many classic assumptions about the role of infrastructures in the urban context. In many grounding works on the role and importance of infrastructures undertaken in the 1960s and 1970s, infrastructures were conceptualized as being a basic service to the population—a view still dominant in urban studies. Nowadays, however, infrastructures are far from being common goods. Even the word “public” of public infrastructures seems to be less than adequate in light of the ongoing privatization and pluralization of these systems. Instead, as specific modes of integration (and this means inclusion as well as exclusion), this mode has become increasingly personalized. If Deleuze/Guattari emphasize the productive force of assemblages in composing frameworks of subjectivity, reconstructing how they historically emerge and dissolve can offer fruitful insights about the impact of infrastructures on the everyday in specific metropoliases.

Second, if we reconsider the definition that infrastructures enable flows (e.g., of people, goods, or information), we must be careful to not simply bestow fluidity and mobility with positive connotations while perceiving immobility as a sign

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51 Fishman, *The Rise and Fall of Suburbia.*
55 Graham, *Disrupted Cities,* 1.
of exclusion and marginalization. As Ash Amin and Nigel Thrift remind us, this bias is very strong in the academic field, especially in cultural studies. It tends to overlook the doctrines at the very core of (neo)liberal ideology of being mobile, flexible, and connected, as for example realized in mobile digitalization.

In recent scholarship that argues along the lines of what Henri Lefebvre, Peter Marcus, and David Harvey have termed "the right to the city," it is not only "the right to stay put" that is of key concern, but also the question of access to urban infrastructure. As van Laak reminds us, in the context of international development aid, poverty is nowadays also predominantly defined as the lack of a minimum of infrastructure, like clean drinking water, mobility systems, or the existence of a sewer system. Even so, in a broader perspective, neither denying nor forcing a population to be connected to infrastructural services appears to be appropriate for realizing a livable and "just" metropolis. That infrastructural regimes are more and more decoupled from political control and democratic decision making complicates this fact. For an increasing number of scholars and activists, however, the transformation and increasing importance of infrastructure in processes of segmentation in the cities seems to be too significant to leave them to economists and technocrats.

Third, while urban theory has slowly started to address the importance of infrastructures, pioneered by the authors discussed above, the question of its object remains problematic since the founding of the discipline. However, critically engaging with some classic studies in this field in the light of these new developments might provide some insight. In 1938, Louis Wirth, one of the founding fathers of urban studies, famously addressed the question of how to define the urban lifestyle. While of course tending to downplay the built components of the city in favor of an urban ecology approach, he defines four elements as key in defining a city: size, density, permanence, and heterogeneity. Despite also being criticized, Wirth's approach has been very influential. Even though his four criteria were developed to address the human population of cities, we can actually use them in the task of addressing questions of the machinic metropolis and the role of urban infrastructures. As these vast socio-technical meshworks juxtapose nature, politics, people, and materialities, they not only establish specific forms of density, but also a certain kind of thickness. While each type of infrastructural assemblage adds new spaces, rhythms, and temporalities to the city, these various strata must be connected to each other to allow for their specific functionalities to unfold. This results in multilayered and interdependent spatial configurations, whereby various infrastructural territories and codings become interwoven into the thick fabrics of urban life.

If we understand the history of urban development as a history of infrastructural implementation and usage, urban infrastructures could actually deliver one possible answer to the ongoing debate on the status of the urban. One could ask the question whether to a large extent it isn't the large, dense, permanent, and heterogeneous accumulation of infrastructures that make a metropolis? While it might overstretch the argument to claim that an agglomeration of human settlement only deserves to be called a metropolis if it actually has a metro system, there is an element of plausibility here. Perhaps we hesitate calling Dubai City a metropolis precisely because it lacks the vast, compressed, diverse, and always-available infrastructural assemblages so apparent in cities like London, Tokyo, or New York.

If we follow Wirth's argument that the term "urbanism" refers to both a specific configuration of built environments as well as to a genuine "way of life," maybe this also holds true for the concept of "metropolitanism," which this volume aims to explore. If the term "metropolitanism" can be useful to describe the large populations of infrastructural assemblages that allow for the massive and around-the-clock circulation of people, goods, and information, we should ask: what implications does this have on the daily practices and perceptions of its dwellers?

Just to give one example, it is evident that infrastructures both supersede and enable forms of face-to-face social contact and interaction. Following this argument, metropolitanism might be a specific "way of life"—sets of practices, modes of perceptions, and cultural techniques closely related to the possibilities

56 Amin and Thrift, Reimagining the Urban.
58 Henri Lefebvre, Writings on Cities (Chichester: 1996).
and constraints of urban infrastructure. The characteristics of these modes of everyday life, however, have to be characterized in their specific historical dynamic, time, and space; they are obviously distinct in Paris of the middle of the nineteenth century or New York City in the late capitalist era at the end of the second millennium. Therefore, anthropologist Robert Rothenberg’s definition of metropolitanism as a predominantly white, capitalist, and colonial ideology of the nineteenth century refers to a specific form of how metropolitanism has played out. While nevertheless true to a certain extent, the way infrastructural assemblages structure metropolitan conditions could also take very different shapes and forms in the future. To trace and spot these infrastructural assemblages is anything but a sideshow of academic inquiry into the multiple phenomena of urban living. It rather leads into the very core of what we call urban studies.