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## Afterword: Economies of infrastructure

Fran Tonkiss

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'urban life is... a matter of what can be made relatable at any point in time' (Simone 2011, 355).

In their introduction to this special feature, Hillary Angelo and Christine Hentschel make a compelling case for the distinctive character of infrastructure as an object of analysis. Infrastructural forms, they suggest, are especially good to think with given the ways in which they mediate certain 'recurrent binaries' in critical thought – macro and micro, object and agent, human and non-human. This mediating quality has to do, perhaps, with the 'peculiar ontology' of infrastructure as both 'things and relations between things' (Larkin 2013, 329). My interest in this piece is to work at the intersection of some of these categories, in moving from the ethnographic and archival focus of the papers collected here to a conceptual concern with infrastructural economies. Such a move – between specific contexts of infrastructural interaction and more extended economies of infrastructure – is less about a shift up from the 'micro' to the 'macro' than it is about the changing scales at which, and the modes through which, infrastructures make things *relatable*. This movement from the ethnographic and archival to the economic is partly figurative and partly descriptive: such a critical space is opened up by Larkin's (2013, 328) account of infrastructure as an 'architecture of circulation'. In putting various things – materials, resources, capital, information, people – into circulation, in making them 'relatable', infrastructures involve diverse economies of investment, ownership, exchange and use. At the same time, they produce and reproduce distributional inequalities in material, and deeply spatial, ways. Thinking through economies of infrastructure lends itself to the kind of comparative or contrastive urbanism with which the special feature engages. These are architectures of circulation composed around various modes of design and delivery,

structures of provision and regulation, and infrastructural subjects, and which allow for connections and disconnections to be traced across different sites and spaces.

In the discussion that follows, I consider three ways of thinking about economies of infrastructure: the *moral economies* implied by interactions with infrastructure, and with other people through infrastructure; the *political economy* of infrastructural investment, disinvestment and regulation variably instituted by state, corporate, communal and informal actors; and the *auto-economies* of everyday provision which rely on the embodied human labour – whether commodified or not – of infrastructural work.

### **1. Moral economies of infrastructure**

In their capacity to make things relatable, infrastructures have a connective and collective potential which is only patchily realized in actual systems of provision and regulation. Infrastructure systems – from water and energy to transport and communication to sewerage and other waste – represent the most basic elements of collective consumption (and collective disposal) organizing social, economic and environmental lives which are lived, at least partly, in common. As such, the supply of infrastructural goods implies certain kinds of moral economy that often sit uneasily with the more formal economies through which these goods are distributed. At a primary level, a moral economy of infrastructure is bound up with issues of simple infrastructural subsistence – human needs for water, fuel or sanitation are not so variable that deep inequities in their provision, often across the same city, can simply be passed off as neutral market outcomes. The ‘shared infrastructural poverty’ that Livia Chelcea and Gergő Pulay write of in the context of post-socialist Bucharest speaks to a more general logic of mutuality in the consumption of infrastructural resources which in their case is expressed as a commonality of infrastructural scarcity. Socialized systems – whether instituted by state or other communal actors – embed a moral economy of infrastructure in forms of collective investment and collective provision, and the setting of non-market prices for access and use.

The politics that follow from moral economies of infrastructure are manifested in different ways. From water riots in Trinidad in 1903 to mobilizations against water privatization in Bolivia or Argentina in the 2000s, to fuel protests in France and Britain in the same decade, these politics range across ratepayer or taxpayer revolts to labour union, peasant and consumer movements, and variously are directed at access to and pricing of infrastructural goods and their means of production and distribution (see Laurence 1969; Hall *et al.* 2005; Doherty *et al.* 2003; see also Bakker 2010, 140-41, for an extended list of public protests against privatized water internationally). The commodification of resources held in common can be seen to violate certain basic moral economies, linked to fundamental claims for a human right to water; but a moralized politics may also be mobilized around a motorist's declared right to cheap fuel. It should be underlined that moral economies of infrastructure are not necessarily 'ethical' in any normative sense, let alone legal, given the moral economy underpinning various forms of piracy which operate less on the principle of a fair price than of what can be seen as fair game (from illicit electricity hook-ups to the moral economy of 'Love your neighbour, love his WiFi').

In her classic essay on 'The ethnography of infrastructure' Susan Leigh Star (1999) captures very well the nature of these technical systems as systems of *sociation*: infrastructure, she suggests, is both 'relational' and 'ecological'. Networks of infrastructure broker interactions – between people, between things, between people and things – and shape a larger environment that supports, secures and segments these interactions. In making things relatable, infrastructures also sustain wider conditions of urban social life. In rendering infrastructure *social*, Star offers an evocative metaphor for thinking more broadly about the relational and ecological character of social life, the soft infrastructure of sociality that mediates and holds the collective lives of strangers and near-strangers. In the same year in which Star's piece appeared, Rose Gilroy and Chris Booth (1999) wrote in a rather different vein of the 'material and socio-cultural support structures' that help to build an 'infrastructure of everyday lives'. These institutional, material and social resources mediate geographies of production and reproduction. The material infrastructures that bind lives in common provide a physical counterpoint to the socio-cultural bases for relation and circulation; the premises on which it becomes possible to interact,

including the very idea that interaction is possible. The metaphor is not so wild; if the information and communications networks of which Star writes are more mysterious and less material than sewerage pipes or railway lines, then the sunk infrastructure of sociation is often invisible, but is materially carried by bodies in relations of encounter and exchange. Like material or virtual infrastructures, social infrastructures constitute a kind of latent capacity – for interaction, for exchange, for social reproduction. Moreover, the submerged infrastructure of social interaction is both generalized and highly situational ('ecological' and 'relational', as Star might say); one draws on tools and rules of interaction routinely and often unconsciously, but always in the context of specific settings and social encounters, however glancing.

This is to play on Simone's (2004) notion of 'people as infrastructure', describing the way that informal patterns of transaction trace out networks of exchange in the city, assembling and reproducing urban social systems outside the frame of collective norms or formal organizations. We barely notice this infrastructure of sociation when it functions; as with more technical systems, we notice it when it fails; when it divides, but not when it connects. As Joseph Ben Prestel shows in his piece on the development of railways in Cairo and Berlin, these are infrastructures of spatial integration and connection but also – and often at the same time – of social segregation and distinction. 'Indifferent' infrastructure is not only consistent with, but conducive to, forms of differentiated citizenship – as Anant Maringati and Indivar Jonnalagadda remind us in respect of the forms of cleansing that infrastructure developments entail: from environmental clearing and spatial purification to social decontamination.

## **2. The political economy of infrastructure**

Moral economies of infrastructure – of access, use and price – shadow and complicate efforts by state and non-state actors to organize, regulate and capitalize infrastructural provision. A concern with infrastructure becomes a way of reading more general political-economic processes and shifts, from the ways in which infrastructure 'surfaces' as a problem at points of environmental or economic crisis (as Angelo and Hentschel suggest), to Boris Vormann's critical

argument concerning the extent to which processes of de-industrialization, in New York as in other cities, have been premised on or manifested as infrastructural transformations. Vormann points to how often the 'spatial fix' for various crises of accumulation in fact take the form of an *infrastructural fix*. As he indicates, various kinds of infrastructural fix have been crucial to the material configuration of post-industrial space-economies – as they have been, recently, to government stimulus responses to financial crisis, not only in the United States but very notably in East Asian contexts (see Kalinowski 2015). Infrastructural interventions appear as complex points of intersection between state and speculative interests, and narratives of industrial restructuring can be read in the 'infrastructuring' of the late capitalist city.

A critical concern with infrastructure in this way provides a lens onto processes of economic restructuring, as it frequently does into forms of state restructuring. In Trovalla and Trovalla's usage, the 'failed city' of infrastructural incapacity is rendered analogous to the failed state: just as the latter does not refer to a *non*-state, to the absence or negation of the state, but to a state form – albeit one defined negatively against a Westphalian ideal-type – so the failed city is defined against an 'infrastructural ideal' of integration and efficacy (see Graham and Marvin 2001). The infrastructural imaginary of the failed city is often linked to a 'disastrous tendency' associated with forms of African urbanism (Pieterse 2011), but is expressed very visibly in the 'failed' infrastructure landscapes – rubbish-strewn, blacked out, submerged, stalled – of cities such as Los Angeles or Naples, New York or Istanbul in the face of government failure or corruption, severe weather events or software meltdowns.

Presently, the political economy of infrastructure is most often read in terms of processes and effects of privatization. Complicated patterns of investment, regulation and delivery, however, mean that the contemporary political economy of infrastructure necessarily goes beyond formulaic conceptions of the state, but also beyond unexamined notions of privatization as the main governance game in town. A *lumpen* category of 'privatization' comes apart in specific contexts into diverse forms of investment, ownership, regulation, control, provision and consumption. While it may be true that private interests increasingly dominate the provision of

– and profits from – contemporary infrastructures, such interests are highly variable, more or less coherent, and more or less formal. ‘Privatization’ in this more extended sense goes beyond state transfers and divestments of public utilities and infrastructural assets, to include complex financializations of infrastructure projects and revenue streams, secessionary strategies of infrastructural enclaving, and the petty entrepreneurialisms that marketize various ‘informal’ systems of provision (see Allen and Pryke 2013; Torrance 2008; Graham and Marvin 2001, 2012; Graham, *et al.* 2013; McFarlane 2008). Infrastructure goods and services are produced, exchanged and capitalized at the ‘high’ and ‘low’ ends of privatization processes, as the ‘sewer state’ of modern urbanism (Dunn 2007) cedes ground to global infrastructure funds or in turn to small-scale effluent entrepreneurs. What we might call, paraphrasing Appadurai (2002), the ‘economics of shit’ sees private agents getting their hands dirty in infrastructure markets in a range of ways.

It is a keynote of splintered urbanisms that infrastructure value chains are connected, segmented and distributed across complicated investment and regulatory spaces. These discontinuous political economies of supply map only crudely onto the consumption geographies of contemporary infrastructure. The issues of ‘distributional justice’ that Star (1999) raised in respect of infrastructure access are starkly evident in uneven geographies of provision and consumption which give the lie to any simple understanding of infrastructural resources as part of an economy of ‘flows’ or a ‘networked’ mode of urbanism, where these are understood as somehow integrated, seamless or inclusive. Social and political inequalities become visible in both systematic and contingent maldistributions of infrastructural hardware, resources and services. This most obviously takes the form of exclusions from infrastructural access, but also is manifest in *excessive* access to infrastructure: the environmental ills that follow from low-income or informal housing developed along major road and rail arteries; next to – or on – toxic waste sites, landfills or sewage outlets; in the shadow of power-stations or high-voltage power lines. Exposed infrastructure creates locational advantages as well as producing bad neighbour effects, and these differential proximities reflect and entrench social and economic distinctions. Infrastructural distributions – and the distributional *injustices*

embedded in them – are shaped around both the physical design of things (roads, railway lines, sewers and sub-stations) and the political design of services (transport, water, energy and waste). The physical design of infrastructural environments both reproduces and generates relations of economic and spatial inequity.

These uneven economies of infrastructure put into serious question how far these can be understood as systems of collective consumption. Within contemporary political economies, basic elements of collective consumption – transport, utilities, ecosystem services, open and green space – are in fact less and less *collective* in terms of either provision or access, but subject variously to monopolization by elites and residualization as services of last resort for the urban poor. In such a context, elements of collective consumption – water, air, open space, power, transport, waste – become subject to the same kind of distributional and positional struggles as are other kinds of market and non-market commodity. Class privilege in this context ranges from leverage over basic services and continuous supply in patchy infrastructural landscapes, to the conspicuous consumption of water as a luxury good used to fill swimming pools and tend lawns and golf-courses (see Graham, *et al.* 2013). Alongside large-scale processes of public asset transfer and marketization, operate more *local* strategies of infrastructure privatization. Competition over ‘collective’ infrastructures in this sense is manifest not only in the capture of public provision by more affluent groups, but through secession from socialized systems in private networks and spatial enclaves. Infrastructure elites, that is, may be characterized by privileged access to higher-quality public resources, and in terms of local autarkies that insulate certain users and certain spaces against wider systems outages and failures.

Different modalities of ‘privatization’ in these senses operate at different scales and involve very different actors – from full or partial privatizations of state utilities and public infrastructural assets, to local secessions by the affluent and autarkic, and pirate privatizations of specific lengths of pipeline, radio frequencies or electrical connections. Distinctions between what is legal and what is not are not entirely to the point, here – one of the other ‘recurrent



binaries' that a focus on infrastructure brings into question, that is to say, is that of formal-informal. There are analytical lines to be drawn connecting the self-sufficiency strategies of infrastructural elites to the jury-rigged networks of informal infrastructure that work through siphoned electricity, water theft, oil bunkering, or the everyday sanitation of hanging latrines and improvised sewers (see McFarlane, Desai and Graham 2014). In these diverse contexts, infrastructure systems as 'architectures of circulation' are less connective or collective than they are segmented and competitive.

### **iii. Auto-economies of infrastructure**

Local privatizations of supply – whether as elite opt-out by those who have abandoned the state, or informal hook-ups on the part of those abandoned by it – go beyond conventional infrastructural economies of both big government and big business. Makeshift strategies of everyday provision and re-tooling further subvert infrastructural norms in substituting for technical systems with *embodied* infrastructure. Stefan Höhne writes of the opening of the New York subway system as a signal moment in the formation of a modern infrastructural subject; the habituation of populations to the routine use of new infrastructures, including normalizing the notion of going underground to move about the city. In thinking about the making of infrastructural subjectivities, it is also important to emphasize that individuals are producers as well as consumers of infrastructure. Diverse forms of auto-infrastructure play a significant role in the everyday provision of water, energy, food, transport and information in contexts of infrastructural incapacity or inequality, compensating for or simply out-competing exclusionary, ineffective or unreliable systems provided by state or corporate actors.

Simone (2004) develops his suggestive concept of 'people as infrastructure' with particular reference to networks of exchange, communication and transaction in informal – and often illegal – urban networks; but auto-economies of infrastructure are also instituted further upstream and deeper downstream in infrastructure chains, in the distributed labour of petty infrastructural production, processing, supply, distribution and disposal. Transport services,

information, energy and waste, water and food: extended systems of urban infrastructure are generated through low- or no-tech 'engineering' and embodied solutions. Such ordinary infrastructures are rigged up around human pipelines for carrying water and fuel, the donkey work of informal and embodied transport systems, and dense logistical networks for the low-tech distribution of goods, food and information. These embodied infrastructures are at least as resilient and usually more adaptive than official and technical networks, and often barely more visible. Embodied energy in this form is the most basic component of urban resource economies, while informal and nimble communication and distribution systems provide a critical counterpoint to the bland fetish of the 'smart' city.

These modalities of people as infrastructure extend from face-to-face or ear-to-ground communications networks; to para-transit systems of carts, bicycles and pulled rickshaws as mobile infrastructures for the transport of goods and people; to the garbage pickers, *recicladores* or *catadores* who remove and process waste; and to the hydro- and energy infrastructures composed by women waiting for and fetching water, or gathering wood and other kinds of fuel. Human bodies are the basic carrying element of these auto-infrastructures, in networks of communication, transport, distribution, waste, water and energy ramified around the ordinary labour of talking, listening, carting, pulling, sorting, carrying and waiting. Such soft infrastructures – characterized at once by 'regularity and provisionality' (Simone 2004, 408) – fill in for, compete with or extend incomplete, exclusionary or inadequate networks of hard infrastructure which are often more vulnerable to technical failure, environmental risk, elite colonization or economic collapse.

When Star (1999, 385) refers to the need to 'surface the invisible work' of infrastructure, she might well be referring to this mundane labour of communication, production, transport, supply and distribution that hides in plain sight in the everyday economies of the city. In the context of state and market failures, or more radical forms of public abandonment and private dereliction, human bodies themselves become conduits of exchange and connection, human labour is the primary infrastructural resource, and face-to-face or hand-to-hand interaction

provides the basic network of communication and distribution. There are dangers, of course, in valorizing the improvised remedies of everyday infrastructure as a counter-ideal, either in a commitment to a politics of infrastructure from below or as a preferred conceptual stance on the ways cities work: as Maringatti and Jonnalagadda point out, where ‘scholars [see] slum infrastructures as metabolized and fluid, slum-dwellers very simply see it as incomplete.’ But this does not detract from an argument for recognizing these embodied networks *as* systems of infrastructure. With minimal or no fixed infrastructural base, low-technology and variable degrees of formalization, the auto-economies of people as infrastructure augment, subvert or crowd out more official or ‘advanced’ systems in the environments of incapacity, inefficiency or inequity that carve up contemporary infrastructural landscapes.

#### **4. Conclusion**

The infrastructure of things, with which the analysis of infrastructure conventionally has been concerned, is mediated and underpinned by networks of embodied labour that produce and distribute material goods, circulate and channel information, collect fuel, gather water and generate energy, provide transport services, and dispose of the waste that results. Hillary Angelo and Christine Hentschel ask us to consider the ‘social work that infrastructure does’. It is in the same spirit of critical inquiry that we might look to the social work that *does* infrastructure. Similarly, if we are to think about infrastructure as an ‘architecture of circulation’, this must be conceived not only in the composition of materials but in the articulation of bodies. Social interaction and organization is materialized in physical and embodied infrastructures that connect and disconnect flows of energy, resources, materials, goods, information, waste, and people. From *chai wallah* to cart-puller, water-carrier to waste-picker, the ordinary infrastructures of the city are composed out of this mundane labour of interaction, exchange, distribution and disposal.

This is give a different slant to an ‘infrastructure of everyday lives’ (Gilroy and Booth 1999) that both emerges from and sustains routine exchanges and sunk networks of sociality. It works

around and between the inadequacies and inequities of more formal systems, whether public, private or – more usually – some improvisation on these themes. It is an economy of infrastructure composed not only by objects and technics, but out of human labour and interactions; auto-economies of transport and energy, waste and water, processing, communication and distribution. Infrastructure has the capacity to show us how social organization happens – how an order of things and an ecology of social life emerges – from regular and provisional interaction between people and things. A concern with economies of infrastructure, moreover, requires us to think about infrastructural subjects as producers as well as consumers of infrastructural resources. In surfacing these economies of infrastructure, networks of social action and interaction are called up that both condition what can be made relatable, and who is excludable. In certain contexts the economies as well as the ethnographies of infrastructure become visible in expressed material forms and expended human labour, in systems of shared provision, and in stark lines of infrastructural inequality. Moral and political economies of infrastructure underpin the different ways in which cities are understood and experienced as sites of common life, as a systems of collective consumption, or as competitive fields of scarce goods, uneven access and local as well as large-scale resource conflicts. It is crucial to examine the separative and segmenting effects of these connective systems, but auto-infrastructures also reveal the many ways of making things and people relatable through ingenuity, embodiment and interaction. The economies of infrastructure hold forms of social life together at the same time as they work to set people, places and objects apart.

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