Infrastructures, Anthropology of

CHAKAD OJANI
University of Manchester, United Kingdom

The term "infrastructure" invokes a plurality of parts hanging together to form a larger whole. It also expresses depth. "Infra" indicates that the given structure is found within or below something else (Edwards 2003). Accordingly, an infrastructure is the structural condition of possibility for something that is located on a higher-order level. It is that for which something else becomes an epiphenomenon. The explanatory capacity thus gained lends the term to a wide range of uses. Having originated in the realm of French engineering, infrastructure is now found in contexts as diverse as logistics, economics, and social theory (Carse 2017). Today, almost anything can be said to have an infrastructure: democracy (Von Schnitzler 2016), citizenship (Anand 2017), and knowledge (Bowker 2018).

While the term has by now become prominent in anthropological scholarship, uses of infrastructure as metaphor in social theory by far precede its recent popularity. Consider the Marxist division of society into levels, with a separation between superstructure (politico-legal and ideological) and base (economic). As observed by Hannah Appel, Nikhil Anand, and Akhil Gupta (2018), later theorists would posit the base in infrastructural terms. Hence Louis Althusser (1969) drew from infrastructure's connotation of depth and hierarchy to signal how the superstructure cannot emerge without something more fundamental by which to be supported.

Such conceptions play with infrastructure as a heuristic for theorizing capitalism. Yet, the assumed sophistication of actual infrastructure, conceptualized as a base for more fluid phenomena, has also been understood to index the degree of cultural development along a unilinear, teleological conception of time. Phrased differently, the figure of infrastructure as base may also incite its treatment as a sign of social or cultural progress more amply. This was true not least for nineteenth- and twentieth-century evolutionary anthropologists, for whom infrastructure and technology marked the presumed stage of a given civilization. While such narratives have later been heavily critiqued, it is undeniably the case that the symbolic charge of infrastructures lingers on—not least because they, as that which is situated below or within, are imagined to have the capacity to lay "the conditions for the emergence of another order" (Hetherington 2017, 40). Just consider how infrastructures can index notions such as modernity and development and, in this connection, their capacity to invoke dreams and hopes and gesture promisingly toward the future (Hetherington 2017). We may say that infrastructures are co-constitutive of the condition of modernity (Edwards 2003) as well as symbolizing what the modern presumably is.

This is all suggestive of why infrastructure has entered into anthropological inquiry as something more than just a metaphor. Infrastructures are ascribed with meaning. They are material assemblages that carry promises and therefore matter to people. As

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such, they have an aesthetics, a poetics, and a politics (Larkin 2013, 2018). However, as is often the case with widespread concepts, infrastructure is also plastic (Carse 2017). Its invocation of both depth and scale enables it to travel widely as a metaphor. Hence, infrastructure incites lively debate among anthropologists (Venkatesan et al. 2018). For what is its analytical value if it can stand for almost anything? And does the study of infrastructure really contribute anything specific to anthropological inquiry that the study of other objects does not?

While opinions diverge, what remains clear is that for a discipline that defines itself on the basis of an interest in relationality, infrastructure does not seem to be going anywhere anytime soon. As Penny Harvey (in Venkatesan et al. 2018, 6) has noted, "infrastructures emerge as classic anthropological entities, relational distributed things that are also and simultaneously relations between things." It follows that infrastructures share with other objects of anthropological inquiry a number of different possibilities for ethnographic exploration. Two predominant possibilities stand out: we may ask about the relations that infrastructures are constituted *by*, on the one hand, or the relations that infrastructures are constitutive *of*, on the other hand. We may settle for one of these possibilities or, alternatively, inquire into the relations between them. The following sections map out what these questions entail for what infrastructure in turn becomes.

Constitutive relations

The figure of infrastructures as things that hold other things together invites the notion of "infrastructural inversion" (Bowker and Star 1999). The idea proceeds from the observation that, although often spectacular and highly visible (Larkin 2013), infrastructural *work* often sinks into the background and drifts out of awareness. As long as they operate smoothly and are successfully held together, infrastructural relations enable the movement of things as diverse as people (Fisch 2018; Harvey and Knox 2015), water (Anand 2017; Barnes 2014; Von Schnitzler 2016), energy (Boyer 2019; Howe 2019), oil (Appel 2019; Mitchell 2011), and various forms of information (Bowker and Star 1999; Starosielski 2015). Humming silently in the background, they become "the invisible backdrops to social action" (Harvey, Jensen, and Morita 2017, 3).

In this connection, infrastructural inversion sets out to shift focus away from the meanings that people ascribe to these material assemblages to instead surface the silent and mundane work they achieve (Star 1999). Without neglecting the symbolic, the focus is extended to include also the material, thus enabling the exploration of relations between these two categories and, concomitantly, blurring the boundaries between them. Infrastructural inversion explores how infrastructural relations stretch far beyond the more obvious boundaries of a given material assemblage. Instead, infrastructures are revealed as chains of relations that enfold "bodies, societies, and *also* knowledge and discourse in ways often unnoticed" (Harvey, Jensen, and Morita 2017, 3; emphasis in original).

Such inquiries have steered attention to how the smooth flows that infrastructures sometimes permit are in fact fragile achievements. The idea that infrastructures hold

together is something that cannot be taken for granted. The question thus becomes one of exactly how they manage to do so, "*against the odds*" (Harvey, Jensen, and Morita 2017, 11; emphasis in original). Such observations have in turn highlighted everyday practices of repair and maintenance as key to understanding infrastructures and, by extension, the conditions of urban life they help to constitute (Graham and Thrift 2007).

Infrastructures' fragility further means that they are vulnerable to operational failure or breakdown (Star 1999). While infrastructures tend to be designed so as to reduce the likeliness of disaster, they often end up producing new and unanticipated risks. Paradoxically, the more extended an infrastructure's constitutive relations and the more successfully it manages to run smoothly and escape awareness, the larger the potential catastrophe. Accordingly, recent scholarship takes infrastructural inversion beyond a conceptual–analytical category. These studies highlight how inversions may happen also for interlocutors themselves, not least in situations of failure and breakdown. In such contexts it is no longer the analyst who performs the inversion and traces infrastructural relations. Rather, the interpretative work happens first empirically–ethnographically as interlocutors themselves become aware of infrastructural relations previously backgrounded (Morita 2017).

At times, infrastructural inversions reveal relations between elements that are otherwise not deemed infrastructural but that turn out to be crucial for the working of a given infrastructural system. These might be the organizational forms that make the production and maintenance of an infrastructure possible (Gupta 2018), but they may also include various more-than-human elements. Relations to the latter in turn unsettle separations between what Geoffrey Bowker (1995) calls first nature and second nature, where the infrastructural, as built environment, is often assumed to belong strictly to the latter. Accordingly, anthropological scholarship on "environmental infrastructures" (Jensen 2015) has shown how aquifers (Ballestero 2019), rice (Morita 2017), and forests (Carse 2014) become folded into the infrastructural, thereby upsetting any clear-cut separation between the infrastructural and the natural.

These inversions—whereby figure becomes ground and vice versa—raise the question of where an infrastructure can be said to begin and end. They also invite inquiry into what infrastructure, as that which is ground to something else, is in turn a figure for. In short, if infrastructure and environment are not easily separable, then how do we tell the two apart? What is the infrastructure of infrastructure?

Figure or ground?

The point about infrastructure's permeation into the categories of nature and environment can be made also in a somewhat different sense. Our infrastructural dependence on fossil fuel, and the way our infrastructures in turn impinge upon that which we experience as our environment, is telling of how the latter "is as much the result of infrastructural history as natural history" (Hetherington 2019, 3). If the environment could once unproblematically be posited as the infrastructure of infrastructure, then the point about it having itself been shaped by infrastructure introduces reason to hesitate. For as Kregg Hetherington (2019, 6) points out, "such a distinction no longer works

when it is our infrastructures of global transportation and consumption that produce the anthropocenic environment on which infrastructures are built."

As such, the positing of something as an infrastructure for something else becomes an analytical gesture that introduces a difference, both when it is made conceptually–analytically by the ethnographer and when it is made empirically–ethnographically by interlocutors. It is an analytical moment or "interpretative tactic" (Hetherington 2019, 6) whereby a distinction is drawn between figure and ground and "where infrastructure appears to be the background to something else" (Hetherington 2019, 6). Accordingly, the analysis of infrastructure may be framed as an inevitably critical endeavor comparable to other critical analyses, for instance of "class relations, conditions of possibility, or semiotic structures" (Hetherington 2019, 6). Recall the Marxist division between base and superstructure, and subsequent framings of the former in terms of infrastructure.

Yet, if Hetherington frames inquiry into infrastructure as necessarily critical, recent focus on the generative potentials of infrastructures goes for some under the banner of "acritical" (Jensen and Winthereik 2013). This is perhaps because the initial impulse is not to unmask something more contingent and of a higher order with reference to something deeper, more fundamental, and fixed. Rather, infrastructures are treated as in and of themselves unfinished. While they speed other things up or down and thus configure time, infrastructures are also themselves temporal and contingent (Appel, Anand, and Gupta 2018). This is true in the sense that infrastructural projects can be delayed, suspended, or reversed and also with regard to how materials become subject to decay from the moment a given construction is "complete" (Gupta 2018). Yet it is just as much the case in that the question of what an infrastructure can do is something that still hangs in the air (Harvey 2018). Infrastructures become not fixed contexts for the epiphenomenal, but rather contingent processes whose generative effects remain uncertain.

What is important to emphasize here is that infrastructures can help to engender new contexts for themselves, much like how their unanticipated consequences, not least in our contemporary condition of climate change and environmental destruction, blur the boundaries between themselves and their environments. By way of looping effects, infrastructures may recursively fold over and into themselves (Jensen and Winthereik 2013). Hence, they upset our analytical attempts to posit them as mere grounds. They suddenly become worthy of ethnographic attention not for their capacity to serve as explanations for things that are assumed to be less rigid, but because they are in and of themselves dynamic and able to surprise.

Structuring effects

When infrastructures are approached as morphological and generative, they increasingly take on the form of media (Peters 2015). As relations that render other relations (im)possible, infrastructures do much more than establish connections between existing entities. Akin to other media, they may instead be understood as relations through which relata emerge (Barad 2007). That is, the idea that an infrastructural connection

merely plugs a gap between two preexisting entities overlooks how the entities in question are in turn modified by the connection. The things connected can be said to emerge continuously through the relation. Infrastructures are thus "ecological forms" or "material conditions of possibility for life" (Venkatesan et al. 2018, 5) in the widest possible sense. What is more, infrastructural connections might not always engender integration (Harvey 2012). They sometimes in fact *produce* gaps and zones of opacity (Harvey, Jensen, and Morita 2017). Yet at times such gaps may also create altogether new and unanticipated relational possibilities (Elyachar 2010; Simone 2004).

There is thus an element of uncertainty as to what the infrastructural renders (im)possible, and this is what makes infrastructures such interesting ethnographic objects with practically endless possibilities for inquiry. Consider, for instance, the parallel that scholars have drawn between infrastructures and experiments (Jensen and Morita 2015). Akin to experimental practices that by drawing things together also differentiate and thus generate unplanned effects, infrastructures too "hold the capacity for doing such diverse things as making new forms of sociality, remaking landscapes, defining novel forms of politics, reorienting agency, and reconfiguring subjects and objects *all at once*" (Jensen and Morita 2015, 83; emphasis in original).

Consider, in this light, the observation that infrastructures may enfold things as diverse as trees, bodies, and discourse. Consider, above all, that many of these elements become enfolded unanticipatedly, without anyone having ever planned for them to become so. Add to this that infrastructural relations can also be characterized by disconnection, exclusion, and leakage (Anand 2017), and you have before you conditions the effects of which no one can possibly foresee. As large scale and capital intensive, what kinds of structuring effects do infrastructures have? What forms of politics do they give way to? If infrastructures are embedded with the ideas and categories of those who design them, how do these in turn play out when encountering the myriad human and more-than-human entities that become enfolded into their relational fields? How are infrastructures efficient forms of "extrastatecraft" (Easterling 2014), and how may we say that they are never unobstructedly so?

Infrastructures themselves draw on existing power relations in order to materialize (Appel 2019), and it is undeniably the case that roads, pipes, and canals, as "systems and norms of distribution" (Appel, Anand, and Gupta 2018, 10), more often than not help to organize finance, power, and knowledge asymmetrically. This can also be said to be true on other levels. For infrastructures render certain relations possible only by way of blocking other relations out (Von Schnitzler 2018). Their enabling effects may even be said to be a consequence of how they shut down alternatives; think of how pipes lead water in desired directions only by obstructing its otherwise unruly and unpredictable flow. Differentiations happen not least in the way infrastructures structure our everyday lives, intimacies, routines, temporalities, rhythms, and movements (Fisch 2018; Star 1999). Not only might resources be actively redistributed to "a relatively powerful few" (Appel, Anand, and Gupta 2018, 10) but groups may also "identify everyday relationships with infrastructure marked by interruption, improvisation, and modification as a metonym of their marginality" (Appel, Anand, and Gupta 2018, 11).

Accordingly, infrastructures seldom come without publics (Collier, Mizes, and Von Schnitzler 2016). While infrastructural publics are constituted and controlled by these

material assemblages, users may nonetheless make demands on infrastructures to serve and subjectify them in various ways (Appel, Anand, and Gupta 2018). At other times, infrastructural publics might be "impossible" (Harvey and Knox 2015), not straightforwardly lending themselves to be drawn together and enacted in ways intended by planners or designers. Conversely, infrastructures are sometimes formed so as to *prevent* the formation of publics (Von Schnitzler 2018). Yet infrastructural contingency in the form of leaks (Anand 2017) and breakdowns (Morita 2017) means that infrastructures may in turn become subject to users' reinterpretation, tinkering, sabotage, or repurposing (Anand 2012; Von Schnitzler 2016) and thus diverge even further from blueprints. The looping effects discussed above are further complicated by such reconfigurations.

If infrastructure once entered social theory as a metaphor, then we have seen how it has shifted to become not only an object worthy of ethnographic attention but also one of such great importance to anthropological interests in politics and the mundane that it cannot be overlooked. Seemingly fixed and dull, infrastructures have proven dynamic and unpredictable. At the same time, infrastructure retains its metaphorical quality. As Ashley Carse (2017) has suggested, we should attend to infrastructure both as material assemblage and as abstraction. As we have seen, infrastructures do things. Yet infrastructure is also an analytical gesture. Akin to how infrastructures feed back into themselves by modifying their own human and more-than-human environments, such analytical gestures may also fold back over and into themselves and upset our own attempts to separate figure from ground. Importantly, infrastructure as metaphor is something we and our interlocutors alike deploy as a descriptive and sense-making device. All this is suggestive of how the study of infrastructure requires long-term ethnographic inquiry and, not least, the many infrastructures that render such studies possible to begin with.

SEE ALSO: Anthropocene, The; Built Environment; Digital Anthropology; Energy Flow and Management; Environmental Vulnerability and Resilience; Landscape; Marxism; Material Culture; Materiality; Media Anthropology; Modernity; Multispecies Ethnography; Nature, Concepts of; Objecthood; Political Anthropology; Political Ecology; Political Economy; Power, Anthropological Approaches to; Redistribution; Roads; States; Technology; Technology and Development; Transport, Communications, and Infrastructure in International Development Contexts

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