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To cite this article: Casper Bruun Jensen & Atsuro Morita (2016): Infrastructures as Ontological Experiments, Ethnos, DOI: [10.1080/00141844.2015.1107607](https://doi.org/10.1080/00141844.2015.1107607)

To link to this article: <http://dx.doi.org/10.1080/00141844.2015.1107607>



Published online: 19 Jan 2016.



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# Infrastructures as Ontological Experiments

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**ABSTRACT** *Infrastructures have conventionally been viewed as material substrates underlying social action. On this basis, cultural anthropology has engaged infrastructure as vehicles through which political values and symbols are made manifest. In contrast, this introduction, and the contributions that follow, specifies an orientation to infrastructures as ontological experiments. At issue is a view of infrastructures as experimental systems that integrate a multiplicity of disjunctive elements and spin out new relations between them. The result is the creation and transformation of different forms of practical, materialized ontologies, which give shape to culture, society, and politics. Given that these transformations are often slow and incremental, they often unfold under the radar of anthropological analysis. However, we argue that it is important for the anthropology of infrastructure to find ways of bringing their world-changing capacities into view. The paper ends with a brief introduction to the contributions of the special issue.*

**KEYWORDS** *Culture, infrastructures, experimental systems, ontologies, politics, STS*

## From Cultures(s) to Infrastructure(s)

In the late 1990s, the critical anthropological reappraisal of culture was well underway. The Boasian notion of ‘the world as a mosaic of separate cultures’, wrote Gupta and Ferguson in the introduction to *Culture, Power and Place* (1997: 1), had led to a conception of cultures as self-contained systems of meaning, which the anthropologist was to understand in their individual totalities. But in the 1980s and 1990s, they continued, this holistic vision had given way to forms of analysis that picked apart the supposed boundedness of cultures and emphasized fragmentation, bricolage, and power. Yet, Gupta and Ferguson suggested, it remained unclear just ‘what such a shift might mean for ethnographic practice’ (3).

Their argument centred on the importance of analysing the entwinement between cultures, and their transformability. This entailed an ethnographic focus on how culture was spatialized, and on how spatialization related to power. Rather than ‘opposing autonomous local cultures to a homogenizing movement of cultural globalization’, Gupta and Ferguson advocated documentation of the ways in which ‘dominant cultural forms may be picked up and used – and significantly transformed – in the midst of the field of power relations that link localities to a wider world’ (5).

If we begin the introduction to this special issue on infrastructures as ontological experiments by highlighting this particular agenda, it is because it has significantly shaped cultural anthropology over the last 25 years. Indeed, as we indicate, much of the emerging anthropology of infrastructure continues to rely on a view akin to that of Gupta and Ferguson’s. Subtle and powerful as this agenda has been, however, here we invoke it mainly as a contrast to another perspective; one that sees infrastructures as experimental systems that generate practical ontologies.

Gupta and Ferguson were certainly not the first anthropologists to promote the analysis of relations between diverse social groups, cultural forms and issues of power. As early as 1940, Max Gluckman examined the opening ceremony of a Rhodesian bridge with a view to understanding how spatial patterns embedded power relations between local people and white colonizers. Infrastructure, in the form of bridges and road networks, was located at the intersection between colonial space and local practice. From that position, it played a key role in socially charged negotiations over power.

Later, June Nash’s influential *We Eat the Mines and the Mines Eat Us* (1979), regarded as a precursor of anthropological studies of the capitalist world system, unfolded amidst vast mining infrastructures. Nash explored connections between pneumatic drills, massive pipelines, and air compressors, which in turn mediated the shifting subject positions and identities of differently located social groups – such as miners in underground shafts and engineers and administrators in plants and offices. Yet, in spite of the strong ethnographic presence of infrastructure in these early examinations of the relations between space, culture, and power, neither Gluckman nor Nash explored infrastructures in much *conceptual* detail. It would be some twenty years *after* Gupta and Ferguson’s initial call for a spatio-political agenda before anthropology really began catching up with infrastructure.

As documented in Brian Larkin’s review article ‘The Politics and Poetics of Infrastructure’ (2013), recent years have seen a veritable explosion in anthropo-

logical studies of infrastructures. This emerging body of work has been inspired not least by work in science and technology studies (STS) centring on studies of distributed technological and knowledge systems (e.g. Hughes 1983; Latour 1996; Edwards 2010). Indeed, encounters between STS and anthropology over the last decade have led to renewed consideration of the very analytical rubrics of pluralized and interacting cultures. For example, recent years has seen an intensified interest in the processes of materialization through which the 'global' enters the 'local' (and *vice versa*) (e.g. Jasanoff & Martello 2004; Tsing 2005; Blaser 2010; Jensen & Winthereik 2013). If anthropology retains its enduring interest in understanding the (cultural) potentials for transforming dominant political forms, surely infrastructures are among the most powerful of such forms. The premise of the present special issue is that infrastructural change, slow and incremental as it often is, unfolding under the radar of critical social analytical attention as it often does (Bowker & Star 1999; see also Jensen 2010: 119–137), offers a distinct vantage point for understanding social and political change – *among other things*.

Because infrastructures at once integrate a multiplicity of disjunctive elements (from ditches and canals to state bureaucracy, rice farming practices, and hydrological models) *and* spin out new relations between them – in processes akin to what Andrew Pickering has described as a 'dance of agency' (1995) – we engage them as *open-ended experimental systems*. The outcomes of infrastructural experiments are differently configured practical ontologies, which *give form* to culture, society, and politics. Thus, our contributors offer a series of ethnographically grounded, conceptually innovative papers, all of which grapple with infrastructures as experimental systems and with the ontologies they shape.

### Infrastructures as Ontological Experiments

In order to pinpoint some important features of infrastructures as ontological experiments, Brian Larkin's recent state-of-the-art review (2013) offers a valuable counterpoint.

In this review, Larkin criticized STS studies for their narrow preoccupation with technological systems. Generally, he suggested, these studies failed to take into account power, culture, and imaginative practice. The obvious point of this critique was to clear space for a distinct anthropological perspective. Yet, the critique misfires: Since the early days, STS studies of infrastructure have explicitly aimed to deal with many of the same issues for which Larkin claims anthropological distinctiveness.

As regards cultural practice, it is worth noticing that the early STS studies viewed knowledge of navigating infrastructure to be ‘learned as part of membership’ in communities (Star & Ruhleder 1996). Or, as the historian of science Paul Edwards noted: ‘societies whose infrastructures differ greatly from our own seem more exotic than those whose infrastructures are similar to ours. Belonging to a given culture means, in part, having fluency in its infrastructures’ (2003: 189). Star (1991) similarly insisted that peoples’ experiences of infrastructure are structured by power relations. Given the resonance between these views and the anthropological perspectives described by Larkin, it appears somewhat disingenuous to characterize the recent anthropological forays into infrastructure as defining an alternative to the reductions of STS. It would be more accurate to say that the surging anthropology of infrastructure travels a path *paved by* earlier STS explorations.

To articulate the implications of viewing infrastructure as open-ended experimental systems, however, it is fruitful to begin with some of Larkin’s other evocative characterizations. Infrastructures, he wrote, are ‘objects that create the grounds on which other objects operate, and when they do so they operate as systems’ (2013: 329). Moreover, infrastructures are ‘matter that enable the movement of other matter’ (329). ‘Their particular ontology’, Larkin wrote, ‘lies in the fact that they are things *and also the relation between things*’ (329). Each of these formulations ties in with some central concerns of the present issue.

For one thing, the insistence on relational specification entails that infrastructures do not mirror social relations, but rather reconfigure them, in the same process as they reconfigure ‘natural environments’. Indeed, what can be perceived *as* ‘social’ or ‘natural’ in and for particular ‘cultures’ is, to a significant extent, the *consequence* of infrastructural arrangements. Thus, for example, infrastructures create different kinds of relations between people and states (Harvey 2010; Pedersen & Bunkenborg 2012; Reeves 2016), spirits (Ronell 1989; Ishii 2016), forms of knowledge (Jensen & Winthereik 2013; Morita 2013; Walford 2013), and nature (Carse 2012; Morita 2016). While Larkin emphasizes the particular ontology *of* infrastructure, we therefore see infrastructures as emergent systems that *produce* novel configurations of the world – new *practical ontologies*.

Central to the potential of infrastructures for bringing about such new configurations is its role in mediating between, and thereby transforming, spatially, and temporally distributed practices. For one thing, infrastructures organize flows of materials and create relations between the dispersed practices and activities connected to such flows. For another, they mediate between those

for whom infrastructures are typically *foregrounded* and those for whom they tend to be *backgrounded*. As Bowker and Star (1999) noted, for example, a kitchen pipe is usually background for those who cook dinner but foreground for plumbers and architects. This is one sense in which infrastructures are at once ‘objects that create the grounds on which other objects operate’ and ‘also the relation between things’ (Larkin 2013: 329).

The term experimental systems was originally coined by the historian of science Hans-Jörg Rheinberger (1994) to denote the interrelated set of devices, forms of practice and organization, and conceptual frames that facilitate the making of scientific knowledge. Crucially, though scientific experiments are in many ways highly controlled, experimental systems often generate effects planned and foreseen by no one. It is precisely this dimension of surprise that we aim to highlight by designating infrastructures as experimental systems. Because the varied practices that infrastructures connect each have their own inertia – constraints stemming, for example, from historical, technical, and geographical conditions – they are often very difficult to coordinate. New designs have to make compromises with existing configurations, and actual forms of use routinely diverge from the intentions of planners. The experimental dimension of infrastructures is due, in large measure, to the complexity of these interactions. The effect of these processes is a largely unpredictable set of infrastructural reconfigurations. Slowly, often imperceptibly, infrastructures change, and change subjects and objects along with them. In the aggregate, what is at stake as infrastructural experiments unfold is the re-composition of practical ontologies.

In contrast with current anthropological discussions of ontology, which centre on the extraction of indigenous concepts and their re-specification as anthropological concepts (Holbraad 2012), our usage of the term practical ontologies focuses on material-semiotic reconfiguration (Gad *et al.* 2015). Through a complex arrangement, for example, the piping system of a building coordinates water flows and usage in kitchens, toilets and baths. Thus it makes up (part of) a material *world* in and through which people live; one with which they might, of course, in turn, tinker, and interfere.

But more is at stake than human activities, for a focus on material-semiotic experimentation also makes it possible to take into account non-human activities. After all, infrastructures are inhabited by entities as diverse as microbes, rice crops and spirits. In turn, the relations of such entities to social practices, and their varied consequences for peoples’ lives are mediated and transformed by infrastructure.

Viewed as open-ended experimental systems that generate emergent practical ontologies, infrastructures hold the potential capacity to do such diverse things as making new forms of sociality, remaking landscapes, defining novel forms of politics, reorienting agency, and reconfiguring subjects and objects, possibly *all at once*. It is of course up to ethnographic elucidation – as exemplified in the contributions to this issue – to pinpoint precisely whether and how this happens.

### **Beyond Politics and Poetics**

Offering a classification of the ethnographies of infrastructure that have cropped up over the last years, Larkin suggested that the specific interest of anthropology lies in eliciting infrastructural extensions into ‘domains such as practices of government, religion or sociality’ (2013: 328). The review organized the existing corpus of materials in two thematic categories focusing on politics and poetics. Anthropologically speaking, Larkin insisted, infrastructures ‘need to be analysed as concrete semiotic and aesthetic vehicles oriented to addressees. They emerge out of and store within them forms of desire and fantasy and can take on fetish-like aspects’ (329). In addition, people have ‘deeply affectual’ relations with infrastructure and ‘the senses of awe and fascination they stimulate is an important part of their political effect’ (334). Part of the appeal of politics and poetics is that the two categories seem ‘naturally’ complementary; one to do with hard realities, one with softer imaginations. Yet, both share some limitations that can be elucidated from the perspective of ontological experimentation.

One of the key aspects of recent ethnographies of infrastructure is undoubtedly their keen interest in (neoliberal) political projects (e.g. Chalfin 2008; Appel 2012; Dalakoglou 2012). Indeed, in this sense they can be seen as extending and amplifying Gupta and Ferguson’s proposal for an anthropology focusing on the relations between spatialization and power. Nevertheless it is also the case that these studies often rely on rather *stabilized concepts* of the political. Infrastructures, that is, tend to be seen as giving material form to an (often neoliberal) politics, the characteristics of which, rather than questioned, are often taken for granted. The consequence is that politics emerges in the form of a general context that shapes, or somewhat mechanically ‘seeps into’, new infrastructures (e.g. Masquelier 2002). However, if infrastructures are conceived of experimental systems that generate emergent practical ontologies, *then the shape of politics and power is one of the outcomes of infrastructural experiments* (von Schnitzler 2008; Jensen and Winthereik 2013; Chalfin 2016).

This does not entail any general claims about dramatic or inevitable changes at the level of formal, procedural politics, or of public debate. The point is rather that by simultaneously (and massively) transforming material environments, and such diverse things as living conditions, economic opportunities, accessibility of goods and services, or health risk profiles, infrastructures change worlds. To our minds, the material-semiotic reconfiguration of worlds is indeed a crucial aspect of the *dynamics* vividly articulated by Larkin's suggestion that infrastructures are *at once things and the relation between them*.

As regards 'poetics', infrastructures are certainly occasionally 'loosened from technical functions' (Larkin 2013: 335). Undoubtedly, they create affective relations and political imaginaries (Sneath 2009; de Boeck 2011) that can be analysed in terms of symbol, myth, or fantasy (Barker 2005; Humphrey 2005). Even so, just as politics is generally conceived to be a human activity that may *influence* infrastructure but will not be redone *by* it, a focus on the poetics of infrastructures is premised on a humanist orientation. Conventionally, poetics is the study of the aesthetic and literary forms of poetry, and their ways of affecting reader experiences. This human-centred orientation is retained when the rubric of poetics is transposed to infrastructures, and the consequence is a focus on the imagination. Yet, important as this focus is, it does not enable engagement with the many forms of non-human activity that proliferate in and around, and help shape, infrastructures. Thus, a poetics of infrastructure can have nothing to say about the *agencies* of sewage pipes and bacteria (Jensen 2016), bio-digesters (Chalfin 2016), or gods living in special economic zones (Ishii 2016), except insofar as they are processed by the symbolic capacities of the experiencing subject. Yet, as we have emphasized, those imaginative capacities are themselves *shaped relationally* by encounters with non-human others.

In some sense, it is perfectly understandable that the scholarship surveyed by Larkin takes a broadly human-centred view. After all, anthropological fieldwork has traditionally focused on engaging with, and talking to, people. Yet, getting into view the infrastructural liveliness of entities like gods and bacteria, as well as their varied implications for societies, culture, and people, requires developing ethnographic modes of attention that are not *centred* on the human actor, which is not to say that this actor simply disappears.

One methodological entailment is thus a focus on how complex *entanglements* between infrastructures and nonhumans become matters of concern for particular people, such as the scientists, engineers, and other people that care about them. Because new ontologies emerge out of such entanglements, it is



crucial for the anthropology of infrastructures to find ways of shedding light on them.

### The Papers

In different ways, all of the contributions grapple with the question of how to develop decentred ethnographic modes of attention, description, and conceptualization, capable of getting into view non-human agencies without letting go of human ones. Casper Bruun Jensen's 'Pipe Dreams: Sewage Infrastructures and Activity Trails in Phnom Penh' offers an ethnographic examination of a long-term project to improve the sewage systems of Phnom Penh. By way of an 'infrastructural inversion', Jensen argues that the shape of the emerging sewage infrastructures can be used to detect changing contours of social and political contexts. Thus, he follows the *activity trails* laid out by underground pipes and explores how they help recreate not only the 'objective' space of the city, but also the 'subject positions' of those who depend on these infrastructural arrangements. Aside from the infrastructural entanglements of culture, society, politics, and nature, Jensen argues that infrastructures are also catalysts for the creation of new practical ontologies and immanently realized *pipe dreams*.

In "Wastelandia': Infrastructure and the Commonwealth of Waste in Urban Ghana' Brenda Chalfin explores the new, experimental bases for urban life on the margins of society in Ghana. Her particular object of attention is a public toilet complex, Wastelandia, which subsequently expanded into a hostel, site of prostitution, school, and biogas plant. Built in do-it-yourself fashion by a local entrepreneur, Chalfin suggests that Wastelandia 'makes visible the complex relations between urban bodies and evolving infrastructural forms, through which bio-politics on the ground unfolds'. Taking over service provisioning for the 'failed state', this unlikely infrastructure offers a materialized, fragile, and ambivalent version of Hobbes' Leviathan, producing a 'local commonwealth' out of human waste, hostel beds, and bio-digesters.

Continuing a strong (unintended) focus on infrastructures of waste, Penny Harvey's (2016) 'Waste Futures: Infrastructures and Political Experimentation in Southern Peru' focuses on new waste infrastructures in Cuzco, Peru. Examining the varied ways in which engineers, bureaucrats, and local people engage with waste, she shows how existing modes of recycling entail both practical and conceptual sorting mechanisms. New processing plants aim to alleviate local people from the hazards of engaging physically with waste. In these treatment plants, the threats of disease and environmental degradation are

transformed into market values, as waste materials transform into new sources of energy. Harvey's paper reveals 'ontological experiments to produce new material and economic forms that reorient the agency of decomposing matter to positive ends'. These experiments 'elicit new political challenges that disturb existing modes of social accommodation and require people to explore how an ethic of environmental care'. Waste collaborations thus construct new material and social intimacies.

With Miho Ishii's contribution, 'Caring for Divine Infrastructures: Nature and Spirits in a Special Economic Zone in India', the scene changes to South India and conflicts between *būta* worship and economic development. The Mangalore Special Economic Zone has been under construction in Karnataka since 1990. This zone comprises infrastructure such as manufacturing facilities, pipelines and roads, but it also encompasses religious shrines. Arguing that the natural environment of the Mangalore Economic Zone is now fully entangled with its infrastructural environment, Ishii shows that this entanglement also extends to spiritual environments. These entanglements are made visible upon a particularly violent form of infrastructural breakdown, an explosion, which required engineers and managers to work simultaneously on two fronts, creating technological solutions and appeasing angry *būtas* seen by plant workers as the deeper cause of the accident.

Madeleine Reeves' contribution, 'Infrastructural Hope: Anticipating 'Independent Roads' and Territorial Integrity in Southern Kyrgyzstan' considers the anthropological meaning that might be given to territorial integrity if conceived in terms of infrastructural experimentation.

Reeves' empirical starting point is road construction in Kyrgyzstan, undertaken to enable citizens to reach their destinations without crossing into Tajikistan, a possibility that has recently materialized with the making of a new border. Examining infrastructures as experiments in material politics, she approaches the road as 'integral to the project of transforming space into territory'. While the study of borders has often focused on questions of cultural identity and political regulation, Reeves maintains that attentiveness to 'borderland infrastructure' offers fresh analytical purchase. In particular, it facilitates renewed consideration of the notion of territory itself, as a 'fragile effect of successive socio-technical interventions'.

In the final paper, 'Multispecies Infrastructure: Infrastructural Inversion and Involutionary Entanglements in the Chao Phraya Delta, Thailand', Atsuro Morita centres his ethnographic attention on floating rice. In the Chao Phraya delta, certain rice sorts, extending up to four metres in order to keep

up with rising delta tides, have amazed travellers and experts with their capacity for growth. Indeed, outside experts have come to conceive of these species as themselves part of delta infrastructure. Morita's paper thus examines how engineers, scientists, and development experts have related to floating rice and water management in the Chao Phraya Delta as a multispecies infrastructure. Successive managerial and infrastructural efforts, including state sponsored breeding improvement initiatives, make visible the intimate relations between farmers and the natural history of floating rice. Morita's paper thus elicits the infrastructural importance of the usually obscure worlds of rice and delta water.

Together these contributions offer a rich set of ethnographic cases and conceptual resources for understanding the experimental qualities of infrastructures, and their ontological, world-shaping, and multi-layered effects.

#### **Acknowledgments**

We would like to thank the editors and reviewers for their helpful thoughts and comments.

#### **Disclosure Statement**

No potential conflict of interest was reported by the authors.

#### **Funding**

This work was supported by JSPS KAKENHI [grant number 24251017] and the Institute for Research in Humanities, Kyoto University.

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