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Infrastructures of Society, Anthropology of

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Abstract: The concept of infrastructure refers to the embedded, often invisible technical support structures that help to deliver services to a population or organization, most commonly water, energy, and information. Infrastructures mediate human interaction and shape social organization. Anthropology has developed a relational perspective on infrastructures analyzing them as the ongoing interweaving of embodied social and political choices, moral orders, and technical networks. This approach has much to offer for anthropologists, because it is largely based on ethnographic research, shows a deep commitment to materiality as practice and provides a productive way of thinking through the changing relations of center and periphery. It is an area of research with important intersections into the information sciences and urban studies.

Keywords: Computer-supported cooperative work, Dys-appearing, Ecology, Embeddedness, Energopolitics, Ethnography, Infrastructuring, Interpellation, Inversion, Ordering, Relational, Urban anthropology, Utilities

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Introduction

There exist a number of topics within anthropology that for long stretches within the history of the discipline, and somewhat surprisingly, suffered the fate of “handmaiden to other anthropological frames and issues” (Munn, 1992, p. 93). Infrastructure is one of them, the body is another. It is as if their ubiquity, the fact that they “[mediate] all reflection and action upon the world” (Lock, 1993, p. 133), renders them moot and implicit in anthropological inquiry. The concept of infrastructure refers first and foremost to modern technical structures such as roads, power lines, or databases that support particular forms of work and social life. Much of anthropological research, however, has taken place in settings where perhaps technical infrastructures did not play a particularly central role in the organization of social life. And where they did, anthropology, for a long time, was not particularly interested in analytically foregrounding material culture and technical artifacts as infrastructure in the modern sense. Hence, the Azande’s grain storage vessels featured centrally in Evans-Pritchard’s ethnography and his analysis of forms of rational explanation. Yet they were not problematized as part of a technical supply infrastructure that may be implicated in shaping those forms of rational explanation. Infrastructure as an analytical concept in anthropology has thus largely lain dormant until the late 1980s, when research at the interface of ethnomethodology, anthropology, feminist critique, and science and technology studies showed that infrastructure was not simply a technical artifact that supported social life. Rather, infrastructure mediated and shaped social practice (Star and Ruhleder, 1996). This perspective opened infrastructure up as an anthropologically useful concept to think through aspects of the relational work that goes into human interaction and that helps to configure social organization. It has made infrastructure accessible to social and cultural inquiry along new analytic paths, paths that research until then, which had treated infrastructure largely as an object, had not been able to cleave. Neither the structural Marxist analyses of the material basis of the social relations of production nor the detailed attention of the engineers and planners in charge of constructing and maintaining infrastructure as a technical object, turned the concept of infrastructure into one that anthropologists would find particularly useful to think with and to invent around. Today, infrastructure as part of an increasingly relational and practice-oriented thinking is rapidly becoming a well-established topic of

anthropological research, particularly at the intersections of sociocultural anthropology, and science and technology studies with important alliances into the information sciences and urban studies.

This article deals with the analytical, epistemological, and methodological issues that have arisen during research on infrastructure since the 1990s charting genealogies where appropriate. The emphasis is on the new and productive ways in which infrastructure has been problematized (Rabinow, 2003). Infrastructure refers to the embedded, often invisible technical support structures that help to deliver services to a population or organization, most commonly water, energy, and information. Yet, these technical support structures are now conceptualized relationally as transient embodiments of social, technical, political, economic, and ethical choices that are building up incrementally over time. Analyzing infrastructure as part of an ecology of infrastructure thus offers a way for the social sciences to inquire into human interaction and social organization, a way that emphasizes the partial connections between structure and agency, and inquires into the 'how' of connecting and its implications. This thought style has much to offer for anthropologists, because it is largely based on ethnographic research, shows a deep commitment to materiality as practice and provides a productive way of thinking through the changing relations of center and periphery.

The article is divided into three core sections. Section *Analytical Uses* discusses three analytical uses of the concept of infrastructure: ecologies of infrastructure, dys-appearing infrastructure, and infrastructure and statecraft. These are heuristic distinctions that reflect three uses of the concept of infrastructure that are very much aware of and borrow from each other. Section *Epistemological Issues* discusses epistemological issues arising in and from infrastructural research, most importantly the shift from infrastructure to infrastructuring. Section *Methodological Issues* raises a number of methodological points that pertain to research on infrastructuring and that inform a wider debate about the changing practices of ethnography as method.

Infrastructure: Analytical Uses

Ecologies of Infrastructure

Infrastructure is crucial for social organization yet often invisible, physically as well as in social scientific or public discourse. This discrepancy marks the starting point for the research on ecologies of infrastructure that has brought together anthropology, science, and technology studies; history; and information science, and that has been advanced primarily through a focus on informational infrastructures supporting organizations (Bowker and Star, 1999). Ecological infrastructure research has initially developed from the analysis of standards and classifications as practices connecting formal knowledge, social interaction, and organizational structure (Bowker and Star, 1999; Star and Ruhleder, 1996). This thinking evolved into a relational view of infrastructure as a continuous coordinated networking of social organization, moral order, and interweaving layers of technical integration. It refuses to reduce infrastructure to the status of technical object.

Following Bateson's argument that one can only ever study relationships and never a 'thing,' ecological research on infrastructure is interested in the manifold relations between technical structure, routines of work, wider scale organizational and technical resources, as well as heterogeneous communities of users – relations always understood as continuously enacted in everyday practice stabilizing a particular albeit contingent, negotiated order (Bowker and Star, 1999; Law, 1994).

Infrastructure seeps into the background, it sediments out and disappears from view. And with it disappear all the technical, social, political, and ethical choices that are necessarily made during the design, construction, implementation and maintenance of any infrastructure. “[Down-stream], the choices made in the building of the [...] systems may no longer be obvious or even visible to ordinary users. The civics retreats silently into the infrastructure” (Fischer, 2005). Hence “[u]nderstanding the nature of infrastructural work involves unfolding the political, ethical, and social choices that have been made throughout its development” (Bowker et al., 2010, p. 99) and that often appear at the surface as mere technical decisions.

Born out of this ecological perspective, the following criteria have been established to define infrastructure (abridged from: Star and Ruhleder, 1996, p.34):

- Embeddedness: Infrastructure is sunk into other structures, social arrangements, and technologies.
- Transparency: Infrastructure does not have to be reinvented each time or assembled for each task.
- Reach: Infrastructure has a temporal or spatial reach beyond a single event or one-site practice.
- Learned as part of membership: The taken-for-grantedness of infrastructure is a sine qua non of membership in a community of practice. Strangers and outsiders encounter infrastructure as a target object to be learned about.
- Links with conventions of practice: Infrastructure both shapes and is shaped by the conventions of a community of practice.
- Embodiment of standards: Infrastructure plugs into other infrastructures and tools in a standardized fashion.
- Built on an installed base: Infrastructure does not grow de novo; it wrestles with the inertia of the installed base and inherits strengths and limitations from that base.
- Becomes visible upon breakdown: The normally invisible quality of working infrastructure becomes visible when it breaks down.
- Is fixed in modular increments, not all at once or globally. Infrastructure is big, layered, and complex, and hence never changed from above. Changes take time, negotiation, and adjustments.

These criteria are sufficiently generic so as to be applicable to almost any type of infrastructure. They have been widely employed in social scientific research, predominantly in the areas of computer-supported cooperative work and learning environments, ubiquitous computing, and technically mediated forms of health care practices. Recent ethnographic research in this vein reaches from infrastructures of governance and administration in mental health care to urban utilities in the Global South (e. g., Levinson, 2010; Mcfarlane, 2011). More recently, the interest has expanded toward cyber infrastructures (cf Bowker et al., 2010) in domains of knowledge making that have traditionally relied less heavily on technical artifacts, particular the humanities, and in fields that have rapidly risen from local endeavors to truly global networks such as the climate sciences and molecular biology.

Infrastructures build up over time and form layers. It is this temporal dimension of infrastructure, which has interested historians of science in large-scale systems and their infrastructures. Their analyses demonstrate how infrastructures are seldom mere technical solutions to a societal need or want. “We see things and name things differently under different infrastructural regimes” (Star, 1999). Infrastructures mediate the looping between naming and ‘ways to be a person’ thus shaping how people are moving targets (Hacking, 2006). “Infrastructure does more than make work easier, faster or, more efficient; it changes the very nature of what is understood by work” (Bowker et al., 2010, p.108). And as the following section will show, it is not only work. Infrastructuring often has more far reaching and existential implications. It is heavily implicated in shaping the very nature of life, labor, and language (Foucault, 1970).

Dys-Appearing Infrastructures

An important strand in anthropology is interested in the ‘dys-appearing’ of infrastructure (Akrich and Pasveer, 2004). Infrastructure comes to matter in its failing: as acute or chronic infrastructure failure denying access to and fair and equal distribution of the basic means of living. Infrastructure only becomes visible, present, and experienced in its failure to deliver what has been promised by authorities, by development agencies or by narratives of modernity.

This thinking is deeply embedded in the history of anthropology. It has its roots in Marxist historical materialism, translated primarily through the writings of Althusser and Gramsci into the structural Marxism of anthropology in the 1970s, cleansed of its structuralist underpinnings by Bourdieu and particularly Foucault in the 1980s, before opening out into a rich delta of approaches integrating elements of feminist and postcolonial thinking and developing a strong interest in spatial and ecological thinking, particularly in urban studies. The original understanding of infrastructure within this Marxist tradition has been discussed controversially and this is not the place to begin to unravel its complicated genealogy (cf Godelier, 1978). Suffice to say that infrastructure has primarily been discussed as part of the trias superstructure, infrastructure, and ideology, with infrastructure initially understood to be the tangible and material setting within which class struggle needed to operate. Other proponents have conceptualized the differences between super- and infrastructure in terms of function rather than institution.

Infrastructure in these terms becomes one particular social form of production analytically integrating elements of the local ecosystem, productive forces, and social relations of production, and in this almost ecological sense forming the place of class struggle. While there is a chronology to these different readings of infrastructure within anthropology, they certainly do not follow each other in evolutionary succession. Rather, the different readings exist side by side emphasizing different analytical and political concerns.

What unites these different readings of infrastructure is the primary concern with processes of subjectivation or interpellation rather than infrastructure per se. What differentiates them is whether they understand this process of making a subject as a process driven by ideology (structural Marxism, Gramsci), by the micropolitics of power/knowledge (poststructuralism, Foucault) or mediated through ecologies of infrastructure (science and technology studies, Star). Empirically, structuralist approaches display a strong tendency to investigate infrastructure as a technical object and a black box. Not its everyday working practices are of interest, but the fact that it historically embodies ideology and thus materially determines the (re)production of an unjust set of relations of production and exchange. Foucault has turned structuralism on its feet concerning himself with the conditions for the emergence of an apparatus, i. e., the physical, administrative and epistemic mechanisms of power. This approach treats infrastructure still as an object, but with an interest in how that object is engaging in forging relations. The concern lies with the mechanisms through which infrastructure as a technical object makes certain connections and denies others, thereby mediating the micropolitics of power/knowledge. This relational thinking paves the way for the last shift, driven primarily by the social construction of technology and material-semiotics: technical infrastructure is drawn into the mangle of practice (Pickering, 1995). Infrastructuring as a material-semiotic practice makes infrastructure available to cultural analysis not only as an object or the carrier of ideology but as a sociotechnical phenomenon and practice relating technology, actors, and moral orders in specific ways. Infrastructure ceases to be a black-boxed technical object. It is pried open by practice-theoretical, constructivist inquiry revealing the ongoing work that goes into making it into a seemingly stable, technical object. The sharp Marxist distinction between subject and object, which Foucault already problematized when analyzing technologies of the self as relational manifestations of power, is dissolved altogether in the mangle of practice. This does not mean that research on ecologies of infrastructure is not concerned with interpellation and the making of subjects any longer. Yet interpellation as a matter of practice is not about subjects and objects, where subjects are made and objects are invariant contributors to this process. Rather interpellating as an everyday practice mangles subjects and objects, constantly changing roles, perspectives, and agencies thus rendering the distinction meaningless. Water pipes are objects of design practices one moment and defective agents in water delivery in the next. Utility infrastructuring as a material-semiotic practice thus interpellates ‘life as such’ (Fassin, 2009), because it embodies and enacts political and ethical choices and helps to shape the “quotidian practices and [...] ‘microspheres of negotiation’ through which [people access resources]” (Gandy, 2008, p. 125).

Infrastructure does not only dys-appear for those marginalized and in the periphery.

Infrastructuring instead focuses one's attention on the partial connections between center and periphery (Hannerz, 2001). Infrastructure is commonly designed in the center and here it dys-appears in the design and construction process. Struggles arise over defining the problem that infrastructure is meant to solve, over aligning and legitimizing inevitable sociotechnical choices, and overdealing with uncertainty and ambiguity in long-term planning processes. Yet infrastructure dys-appears in the center always in relation to a representation of the site of its deployment, i. e., some idea of the periphery. In the periphery itself, infrastructure dys-appears differently. It dys-appears because it does not deliver what is needed. It breaks down, it has unintended consequences and side effects, and it is appropriated in ways that change its original intent for better or worse or infrastructure does what the center intended, but that is not what anyone in the periphery wanted or needed. Yet these forms of dys-appearing also relate to design and construction choices made in the center. Infrastructuring then focuses the analytical attention on the partial connections between center and periphery, on the way one sees the other, on the exchanges, connections, collisions, and dependencies between center and periphery on different spatial and temporal scales. In fact, center and periphery only take shape the way they do and for the moments they do, because they are partially connected through processes of infrastructuring in specific ways.

Most of the anthropological research in this trajectory of dys-appearing is concerned with utility infrastructure in the major metropolitan regions in the North and South and convincingly demonstrates just how central infrastructure is “in the construction of the city as ‘modern’, as a site of capitalist production and expansion, as constitutive of social relations of inequality, and as a space of environmental transformation” (Mcfarlane and Rutherford, 2008). To a degree, this strand of research remains true to its Marxist roots with a continued interest in the hidden materialized networks of fetishized relations of production and demonstrating the instrumental role of infrastructure in mediating power relations. Many recent analyses in this vein oscillate between foregrounding the political, ethical, and economic choices that go into infrastructure design and operation on the one hand, and on the other hand, the tactics, appropriations, and suffering of those living with the effects of these choices. They oscillate between narratives of top-down power and the manifold resistances against it that are always also articulated in material, i. e., infrastructural terms.

Inspired by the watchful critique of the consequences of increasingly global flows of people, things and knowledge (Appadurai, 1991; Hannerz, 1997), the notion of the assemblage (Collier and Ong, 2005) has advanced a more ecological understanding of infrastructure: “‘Infrastructure’ designates specific institutional, material, or social conditions through which the functioning of a certain technology, ethical regime, form of regulation, or mode of communication is either enabled or impeded. It inscribes the space and form of limited, finite, and localizable relationships and effects that occupy a certain space and that concretely link – or distinguish and divide – various objects, spaces, techniques, individuals” (Collier and Ong, 2003). This definition firmly establishes infrastructure as a coconstitutive part of cities as urban assemblages and extends the concept from its traditional focus on utilities to include

- the political and media infrastructures, i. e., means and modes of representation, and how they contribute to an infrastructure politics;
- people as infrastructure in constellations where the material and technological means are minimal and forming support networks and communities becomes the most important resource; and
- the emergent informational infrastructures that are rapidly changing from top-down service provision to ubiquitous and increasingly user-generated networks of communication and interaction.

Ubiquitous computing, sensing technologies, cartographic techniques, and manifold forms of ‘urban hacking’ are rapidly developing into a pervasive information infrastructure woven into the urban fabric and they are involved in reconfiguring modes of representation and participation in processes of infrastructure development and distribution.

Infrastructure and Statecraft

The governance of and control over infrastructure has always been a crucial technique of modern government. In the longue durée of infrastructure development, infrastructure is an integral part of the architectures of modernity, be it as an element of nation-state formation, of countless efforts of modern state governments to impose a singular order on society, or as an element in late modern attempts at governing increasingly complex urban fabrics. The art of governing in modern societies has always depended on “‘geopolitics’, whereby the state uses technological means to transform the land into both a resource for administration and a symbol” (Mukerji, 1994). If controlling infrastructure is an important technique and strategy of rendering a society governable, it is of little surprise that movements of resistance struggle to (re)gain some control of infrastructures, most recently information infrastructures in movements of political change in North Africa and the Middle East (e. g., Fischer, 2010). Less immediately visible, because it is operating at a much larger temporal and spatial scale, is the intense link between utility infrastructures and the flows of political and economic power at large. The notion of carbon democracy (Mitchell, 2009) focuses historical attention on how the histories of carbon-based fuels, i. e., coal and oil, and Western politics and statecraft are closely aligned throughout the twentieth century. The concentration and control of energy flows shapes democratic possibilities and, during the postwar period, democratic stability and its implicit goal, the growth of markets, have become closely aligned with the circulation of fossil fuels and hence infrastructure and infrastructural decisions.

In anthropology, this historical analysis has been extended into the ethnographic present to investigate energopolitics, i. e., the power over and through energy, in an analogy to bio- and geopolitics (Boyer, 2011). “[...] Power over energy has been the companion and collaborator of modern power over life and population from the beginning” (Boyer, 2011). Particularly as countries all over the world are beginning to face up to the transition to renewable energy sources, existing infrastructures need to be extended or replaced in major national efforts requiring a plethora of political,

technical, economic, social, and ethical choices. The transition into renewable energies requires careful infrastructuring in a political and economic field that is dominated by major industrial actors; a technological field that has not settled on key technologies yet and that is still witnessing a multitude of decentralized, often very local initiatives and innovations; and a civil society particularly in the affluent North that so far shows little inclination to reduce energy use or develop other ways of accounting for its externalities. It is an important task of infrastructure research as part of an anthropology of the contemporary to analyze these processes of energy infrastructuring and understand and make visible the social and ethical implications of choices that are often made as technical choices in the here and now but that have significant global consequences far beyond the present.

Infrastructure: Epistemological Issues

Ecological infrastructure research began to develop in the 1980s, a time in anthropology when important theoretical advances were made through feminist critique, a heightened sense of reflexivity, and the integration of scientific and technological practices into cultural analyses. It is in this intellectual environment that infrastructure ceases to be a technical object or material repository of social and cultural activity. Infrastructure becomes part of material-semiotic practices (Haraway and Jeanne, 1991) and hence part of cultural analysis in very much the same way that science and its laboratories were coming to be understood as intimately and inextricably woven into the fabrics of modern societies (Martin, 1998). Infrastructure becomes legible through the analytical lens of culture; it becomes anthropological strangeness of a second-order, “that of the forgotten, the background, the frozen in place” (Star, 1999, p. 379).

The ecological and relational perspective grants infrastructure a more active role in contributing to material-semiotic practices. This shift in perspective allows the analysis to take into account that infrastructure never really works the way designers intend. Infrastructure always ‘does’ unintended and unforeseeable things and it has to be able to do so. Infrastructure is never simply rolled out into everyday life as the term infrastructure implementation suggests. It needs sufficient degrees of freedom to accommodate the heterogeneity and dynamics of social practices. The fit between plan, infrastructure and social practices needs to be produced and continuously reproduced in situated action (Suchman, 1987) and in careful tinkering (Mol et al., 2010). Hence, infrastructure is not any longer passive repository of a homogeneous culture waiting for an anthropologist to take a reading. It is part of material-semiotic practices and is analyzed in its ability to help or hinder the forging of relations. It is analyzed in its ability to stabilize particular configurations, i. e., its ability to shape culture as practice.

Infrastructure in an ecological reading ceases to be a homogeneous technical artifact. Rather it is understood as a fluid technology contributing to practices in multiple ways. Deleuze captures this new sense when writing about the device: “[a multi-linear ensemble] composed of different sorts of lines. And these lines do not frame systems that would be homogenous as such (e. g. the object, the subject, the language). Instead, they

follow directions, they trace processes that are always at disequilibrium, sometimes coming close to each other and sometimes getting distant from each other. Each line is broken, is subjected to variations in direction, bifurcating and splitting, subjected to derivations” (cited in Muniesa et al., 2007). It is in this sense that the shift is introduced from infrastructure as a noun to infrastructuring as a verb and as an ongoing practice: “Discussing ‘infrastructure’ as a noun [...] suppresses the variety of material and non-material components of which it consists, the efforts required for their integration, and the ongoing work required to maintain it” (Bossen and Markussen, 2010). Hence, the shift from infrastructure to infrastructuring is not only a methodological shift toward the analysis of infrastructure in the making. It is also an epistemological shift toward infrastructuring as articulation work entangling actors, technologies, and moral orders in specific ways. Infrastructuring is never simply the design and bringing into being of a technical artifact but it is an ongoing attempt at ordering social practices, an engagement in heterogeneous engineering (Law, 1994).

Infrastructure: Methodological Issues

Inversion and Othering

This final section discusses briefly three methodological issues that arise in the context of infrastructural research: infrastructural inversion and othering, relationality as an ethnographic challenge and infrastructure as an ethnographic resource. In the late 1980s, the history of science began to analyze large-scale systems as emergent sociotechnical networks concentrating for the first time on infrastructure and technology rather than the people and ideas these were supposed to enable and advance. Bowker (1994) referred to this shift in focus as ‘infrastructural inversion.’ Practicing infrastructural inversion means turning figure into ground and vice versa and investigating not an object but relations (Bowker et al., 2010). Particularly in the history of science, this is a powerful methodological shift that puts the emphasis firmly on sociotechnical networks in the making as well as the choices and path dependencies that channel these developments. Yet there is a larger point to figure and ground reversals that anthropology has raised and that is relevant to the analysis of infrastructuring. Marilyn Strathern points out that figure and ground do not relate to each other in a part–whole relationship constituting some kind of totality. “Figure and ground work as two dimensions. They are self-scaling – not two perspectives as it were, but a perspective seen twice, ground as another figure, figure as another ground. Since each behaves as an invariant in relation to the other, the dimensions are not constituted in any totalising way” (Strathern, 1991, pp. 112–113). One important methodological implication is that the ethnographer may try to oscillate between perspectives and attempt different kinds of involvement in the field. Key to such an approach, however, is not the integration of different analyses into a coherent whole, but rather to explore how they relate to each other, always only partially connected, and how the constant failure of any perspective to capture something whole and complete, starts to produce something interesting when put next to other failures.

The analysis of the literature on infrastructure not only in anthropology shows that each discipline names and treats as infrastructure (ground) that which is not its research object (figure). Thus, the social and cultural sciences interested in social organization and human interaction frame the technical environment of particular situations as (technical) infrastructure. The computing and engineering sciences primarily interested in the coordination of technology and algorithms make social interaction their (social) infrastructure. Thus, disciplinary thinking runs the risk of not seeing figure and ground as partially connected but of othering the ground by keeping it invariant, black boxed, and detached from the analysis. Already in 1935, Ludwik Fleck demonstrated how the philosophizing naturalists of the early twentieth century, e. g., the Vienna Circle, saw facts as variable and human thought and logic as fixed, whereas humanist philosophers thought of facts as fixed and of human thought as variable: “It is characteristic that both parties relegate that which is fixed to the region with which they are unfamiliar” (Fleck, 1935/1979, p. 50).

Relationality and Different Modes of Infrastructural Research

The particularly modern epistemological split in attention to either matter or meaning that Fleck points out continues throughout the better part of the twentieth century and is now increasingly dissolved in relational infrastructure research. Researching infrastructure today always attempts to relate three analytical dimensions to each other: “ubiquity, material and semiotic (texture), indeterminacy of the past (identity politics), practical politics of designing infrastructures (how to do it and the (in)visibilities it produces)” (Star, 1999). Relating these dimensions to each other and exploring the connections between them forces anthropologists to continuously cross established modern boundaries of matter and meaning and of disciplinary thought. Anthropological research on infrastructuring thus not only becomes an inherently transdisciplinary endeavor. It also challenges in different ways the ethnographic method.

First, new models for ‘scalable qualitative research’ (Bowker et al., 2010) are called for, i. e., the variance in the phenomena being studied ought to be matched by the variance in the size of research teams. While there are many very good reasons for individual fieldwork in many cases, there are equally good reasons in the case of infrastructure phenomena that argue for larger teams able to match the heterogeneity and scale of infrastructure. Infrastructures are often distributed across large spaces, they span center–periphery relationships and they connect many different places. There is also a temporal dimension: changes somewhere in the network may have effects in several other locations at the same time. The spatial distribution and simultaneity of infrastructural phenomena challenges the revered ethnographic principle of co-located i-witnessing.

Second, understanding infrastructural phenomena as material-semiotic practices requires multimodal research (Bowker et al., 2010), i. e., diversity in methods and methodologies each with their own strengths and weaknesses. And it requires analytic means of relating the different outputs together: thick descriptions, narratives, technical data, and maps. These cannot be triangulated in any simple sense to achieve a more comprehensive understanding of the phenomenon. Rather the interesting findings come from

understanding how different results partially connect to each other.

Last, new ways of knowing are required if the different methods are not to produce segregated analyses of the social, organizational, technical, and cognitive aspects of infrastructure as if these were somehow sitting on top of and apart from each other and not entangled in highly specific ways. The established textual form of the ethnography has long ceased to be a singular and monolithic narrative. Experiments with perspective, coproduction, and style are widespread. Research on infrastructure encourages anthropology to carry these experiments further into distributed and only partially connected ways of knowing.

Infrastructure as Ethnographic Resource

Another challenge to the co-location of ethnography comes from the ‘intimate sciences’ such as the humanities (Beaulieu, 2010), where knowledge practices are often difficult to engage ethnographically as they are private and individualized rather than collective and publicly displayed, for example, in laboratories. While Wittgenstein alerted not only anthropology to the fact that language and thinking are also embodied practices, this remains difficult to translate into ethnographic research, not because it is an epistemological impossibility to observe thinking practices, but because most people for many good reasons want to be left alone when thinking. Despite this apparent need for privacy, or maybe because of it, cyber infrastructures are playing an increasingly important role in the humanities strengthening networked knowledge practices. These infrastructures can also be conceived of as a resource for ethnographic research as they offer the possibility to create a co-presence of the ethnographer with the research community in question without requiring co-location. Ethnographic copresence has to do with the alignment of observing and observed practices through information infrastructures, sharing channels of communication; of data management; and of reflexive commentary. It offers possibilities to partake in the practices of knowledge production in asynchronous ways and at a physical distance without being detached. It offers more co-laborative roles to the ethnographer than passive observer, including author, participant, and scholar. The multisitedness of the traveling individual becomes here not a matter of sequential co-location, but of interaction distributed along information infrastructures such as mailing lists, Web sites, or databases.

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