INFRASTRUCTURES AND SOCIAL COMPLEXITY

A COMPANION

Edited by Penny Harvey, Casper Bruun Jensen and Atsuro Morita

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Alberto Corsín Jiménez and Adolfo Estalella

Early in February 2014 we received an email inviting us to join a project that went by the name of *Atlas*, the purpose and contents of which remained mysteriously concealed from us. The message included a document that 'defined Atlas' and was structured into six headings or chapters: Map-Territory, Pause-Sequence, Myth-Ritual, Public-Private Space, Critical Object-Accumulation, and Ephemeral-Unfinished. The document resembled, perhaps, the catalogue of an exhibition-to-be.

Some forty people were copied into the original email, most of them belonging to a young cohort of artists, architects and cultural mediators that have over the last ten years coalesced around a project for 'free culture' activism in Madrid. These included architectural collectives Basurama and Zuloark with whom we had ourselves been carrying out fieldwork in the city over the past three years.

As it turned out, *Atlas* was the graduate research project of Madrid-based scenographer, Jacobo García. Despite his youth, García was already well known in various activist circles in Madrid for his creative re-appropriation of a number of occupied spaces in the city by using the language and resources of theatre. This proved to be a novelty in a city whose tradition of occupation had long been dominated by the discourses of political economy and autonomism. In this context, the symbolic and material resources of theatre offered a somewhat different repertoire of analytical forms with which to explore notions of public, private and common spaces; engagement, movement and participation; or affect, embodiment and care.

Over the following months, those who remained interested in the project were asked to produce a 'box' for one of the chapter headings in the *Atlas* document. These boxes would eventually be used to produce an installation performance for Jacobo's graduation viva at Madrid's School of Drama Studies. The call to put 'inside' a box some of the sources that characterized the work of well-known 'outdoors' activists was a provocation of sorts. However, as it evolved over time, *Atlas*'s explicit convocation of an urban-wide apparatus of free culture activism took issue with the very notion of the city as a 'source' for common life. The many collaborators that *Atlas* strategically mobilized had long been struggling and working in 'open-sourcing' their own

architectural or artistic practice in the city. For these collectives, the toolkits of open-source and free culture activism offered a stock of technical and legal, conceptual and political resources with which to refurnish the infrastructural and political capacities of the city (Corsín Jiménez 2014).

Yet what *Atlas* managed to accomplish rather spectacularly was to *theatricalize* the alleged symmetry of all such projects as sources of urban openness. For example, one participant created small sculptures of 'congealed affects' produced by melting wax over objects and mementoes of significance to her, generating a form that was then emptied-out of the material that supported it (see Figure 11.1). These affects were meant to crystallize and make visible the emotional turbulence and topological intensity of specific urban relations. The architectural collective Zuloark, for its part, was challenged to build a 'street parliament' that would serve as 'democratic furniture' for people assembling to discuss matters publicly in the open air (see Figure 11.2a, b). Each intervention thus captured different 'sources' of the idea of the city as an 'open source', and triggered unsettling relations of symmetry between them. The form of theatre – the material, spatial and temporal resources through which the illusions of spectatorship, engagement or performance are designed in a theatrical production – functioned in this context to hold fleetingly and fragilely together the idea of the city as a radical and symmetrical form of openness.

Atlas drew on the dramaturgical resources of theatrical productions to design what we might refer to as an 'ecology of open sources' for the city. It literally laid out an ecological, scenographic and cartographic artefact that

Figure 11.1 Congealed affects
Photograph: Atlas Project

Figure 11.2 (a) Two views of *The Urban Parliament* by Zuloark
Photograph: Adolfo Estalella

Figure 11.2 (b)
Photograph: Atlas Project

was itself sourced on the radical praxis of well-known free culture activists in Madrid (see Figure 11.3). In this sense, we may think of *Atlas* as a pluriverse: a world invested with a commitment towards radical and emergent openness. Yet such a pluriverse was short-lived. It was a product of artistic design, a theatrical experiment.

In this chapter we want to explore some of the issues raised by the production of *Atlas*, in particular the political and infrastructural imagination of the city as an 'ecology of open sources' – or as we shall refer to it hereafter, an *ecology in beta*. Such an ecology, we shall argue, challenges some of the descriptive and conceptual conventions of recent social and urban theory. On the one hand, the work of free culture activists helps cast new light on how and where politics is sourced and re-sourced in the city. This notion of 're-sourcing'

Figure 11.3 Atlas table map
Photograph: Atlas Project

will play an important part in our argument. Re-sourcing points to the materiality that subtends all political work, at the same time as it interrogates the nature of its sourcing – its foundations and support structures but also its springs and openings.[1] Re-sourcing offers an alternative location from where to describe what the city is made up of and how we get to know it. As the example of *Atlas* already illustrates, whatever the political might turn out to be, it is hardly just a space of representation, reclamation or participation. The political is also re-sourced on affective, choreographic and infrastructural dimensions that contribute to its holding in place (see also Corsín Jiménez, Estalella and the Zoohaus Collective 2014)

On the other hand, the notion of an ecology in beta calls also for re-examining social theory's own 're-sourcing' as a methodological and critical design for social life. It helps us articulate a question about the sources and resources that we use in the making of theory, as well as about theory more amply as an open-source endeavour. We may want to ask, for example, what it would take to open-source the methods and infrastructures of theory-making in the social sciences (and anthropology in particular).

Finally, the question of re-sourcing helps us make visible what we believe is an important distinction about the ontologies subtending political life. Thus, the scenography of experiment that *Atlas* set on stage exemplifies contemporary interest in the emergent dynamics of affect and material vitalism that traverse systems thinking today. *Atlas* presents in this light a view of cityness as an ontology that sources the open.

Yet there is an alternative take on the idea of ontological openness that is afforded by a focus on re-sourcing. We will describe a project carried out hand in hand with guerrilla architectural collectives and various community organizations in Madrid when we came to realize that the move from 'sources' to 're-sourcing' demanded our collective designing of an infrastructure of apprenticeships. Re-sourcing apprenticeships, the city emerged not just as an ontology that sources the open but as an open-source ontology.

The city liberated

The global free culture movement saw the light in the 1990s in response to widespread corporate efforts to extend patent protection and copyright control over cultural works (Lessig 2004). Inspired by the copyleft licences of free and open-source (F/OS) software, it quickly spilled over the technical domain of software development to encompass tangible and intangible cultural forms. When we first met Basurama and Zuloark in February 2012 we had already been carrying out ethnographic work among free culture activists for three years in a variety of sites in Madrid, including a social squat center, a media lab and a number of Occupy assemblies. Despite the obvious urban dimension of some of these movements, the relation between free culture and the city remained unclear: what specific qualities did parlance of 'freedom' inflect the architectural imagination of urban public space with? What made a plaza, an

urban community garden or a social squat center 'free'? In the wake of the Occupy movement these became guiding concerns for Basurama and Zuloark. Both collectives had a long tradition of social and urban activism in Spain and Latin America yet in the aftermath of the economic crisis turned their attention to the specific forms of autonomy and sustainability that free culture seemed to open up for urbanism. In part this was provoked by the culture of creativity and collaboration on which open-source projects are sustained, and the promises they seemed to offer against the legacy of ruination brought about by the politics of austerity. But it was also partly a response to the heightened attention paid by liberal governmentality to new trends in sentient and smart urbanism. So let us briefly look at some of these developments before returning to Basurama and Zuloark's experiments with open-source urbanism.

As the editors of the volume have noted, the rise to prominence of the concept of 'infrastructure' has coincided with both the empirical proliferation of new interfaces, media and digital sensor networks and a recent analytical sensibility that attends to the complex, adaptive and emergent processes lending epistemic continuity and/or sustainability to social and biotic systems. Thus, there seems to be growing consensus that the functional and ontological dimensions of self-organized systems are assembled together as relational epistemic ecologies (Morton 2012; Connolly 2013).

Critical geography was perhaps pioneering in its embracing of an ecological framework for approaching the study of urban systems, even though this was at the time framed in terms of the metabolic flows dis/abled by the circulation of capital (Heynen, Kaika and Swyngedouw 2006). Infrastructures stood here as both skeletal support-systems for capital flows and capital-intensive lattices in their own right. Recent years, however, have seen scholars turning their attention away from the political ecology of capital flows and towards the medial and processual affordances of infrastructural work. That is, an interest not only in how infrastructures stand, how they stand out or what they stand for but also in their deportment as *stances* – platforms or stations, but also orientations – through which people hold their worlds together. Thus, there is an awareness today that these stances are mediated, orientated and shaped by a multifarious array of 'sentient' and 'ambient intelligences' (Crang and Graham 2007), from data sensors and 'smart' micro-computational devices to surveillance systems. Nigel Thrift sums it up nicely when he says that:

> [c]ities are more than collections of flows channelled by their various infrastructures: they are not just a set of assembled entities … . Rather, cities are means of revealing new things, means of fostering and animating ramifications which are centrifugal in nature.
>
> (Thrift 2014: 7)

These centrifugal forces build up into waves of anticipation and expectation, westerly winds of data-streams that, in the atmospheric idioms favoured by

urban theorists today, sway and whirl our bodies into larger 'informatic weather systems' (Shepard 2011: 18) and infrastructures of 'network weather' (Greenfield 2009). In other words, cities open up as emergent semiotic life-worlds and forms of 'urban wilderness' (Hinchliffe et al. 2005): luxuriant forests and intensive pressure fields of signals and 'outstincts', as Thrift calls them (2014), that stretch and dilate the terms through which we are urged to rethink the *polis* as a dynamic cosmos.

This casts an exciting and promising scenario for urban theory. Yet we would like at this juncture to return to our account of Basurama and Zuloark's open-source urban projects to offer a gentle ethnographic displacement to this narrative about emergent forms of urban ontological pluralism.

Open-source infrastructures

Open-source architecture poses challenges of a rather different nature to the digital projects that have become flagships for theories of sentient and smart urbanism, or indeed very different, too, from the F/OS software projects that have become widely iconic of social innovation and citizen engagement in the age of the Internet.

For example, open-source architecture is different from F/OS software in that the work of design is different from the final output. Design and output do not coincide in the same object. Thus, unlike software, where writing code is at once a form of self-grounding design *and* deploying infrastructure (Kelty 2008), in the case of architecture one can make designs freely accessible (architectural drawings, 3D renders) yet the actual process of building the infrastructure may still be carried out behind closed doors. In other words, whereas for some digital projects opening access is tantamount to opening the sources, in the case of hardware projects, opening access and opening sources are in fact different operations.

The question of the 'sources' of the urban condition is therefore at the heart of how open-source architecture projects carry out their work. For when guerrilla architectural collectives speak of open-sourcing their practice they don't just mean granting access to their designs. What they mean, rather, is that every stage in the process of designing and building an architectural project should be open. This certainly involves refunctioning the technical, legal and material resources with which they equip their practice: using crea-tive commons or free hardware licences; employing recycled materials; making all designs publicly and freely available, etc. But it also goes beyond such resourceful solutions. Taking seriously the question of how to open the sources of the urban condition demands on the part of these collectives an exhaustive inquiry into and mobilization of the *re-sources* that draw the city together today as a vibrant, emergent and dynamic field. It is the nature of *sourcing* that is at the heart of how the city is assembled as a vital system. There are some examples below:

- The work of sourcing calls for an imaginative exploration of the *visual and iconographic systems* through which objects and interfaces becomes intelligible and usable, not least by those who have never seen or worked with architectural designs before. These novel diagrammatic or 'logo-graphic' systems (Thrift 2009), mobilize and re-arrange media surfaces, digital iconologies, even traditional ideographic resources into intuitive but also radically counter-political informational interfaces (see Figure 11.4).
- It further involves coming up with imaginative solutions to the technical and legal systems, and perhaps most importantly, the *expert and authorial regimes* that underwrite the governance of urban projects. Thus, open-source architectural collectives have come up with novel contractual models that re-articulate architects' responsibilities over the signing-off of construction work. These contractual forms maintain the authority of the architect as the certificatory agent (holding him or her accountable for public liability insurance – in the Spanish context it would be a violation of law to do otherwise) yet they define ways, too, in which local communities re-absorb part of that responsibility in exchange for much longer-term commitments on the part of the architects. Contractual obligations are therefore recast along lines that redefine the temporal expectations and outputs of traditional regimes of commercial liability.
- At the very heart of the work that open-source architectural collectives engage in is also the head-on investigation of *openness as an ontology* – that is, of the material, infrastructural and social capacities that 'source'

Figure 11.4 Pictogramas by Iconoclasistas, a portfolio of creative commons licenced ideograms used to facilitate community storytelling and cartographies
Source: www.iconoclasistas.net/post/picto-2015/

the nature of openness. For example, it is common for guerrilla architects to enlist communities into designing, developing and maintaining the very infrastructures of collaboration that will support future community work (e.g. email lists, websites, archives, auto-construction toolkits) (see Figure 11.5). Thus, for architects, as far as infrastructural installations go, the distinction between human/social and non-human/material dimensions is meaningless and counterproductive. What is at stake is not the ontological status of urban resources but their *re-sourcing*: how does an infrastructure/architectural work become a 'source' of community concerns? How are these various interests and agendas negotiated, mediated and 'mattered' into a project management programme: resources, materials, skills, competences, capacities, tools, availabilities, deadlines, etc.?

- The work of open-source architectural collectives further tests the limits of the city as an administrative unit, confronting numerous *bureaucratic and institutional trials* over legal permits, public liability insurance, tenure rights over public landholdings, access to electricity and water, waste disposal, etc. In facing up to these challenges, guerrilla architectural collectives have taken upon themselves the task of opening up and designing new spaces and forums of political interlocution, enabling local administrations and communities to meet each other outside established frameworks of political bargaining.

- Last, these projects face chronic *funding and financial challenges*, due for the most part to their disruptive and uncertain status, but also because of the ambiguity of their accounting practices (for example, how to account for cooperative and community work). Over the years guerrilla architectural collectives have learned to exploit unsuspected financial openings and opportunities, such as crowdfunding, local patronage or community sponsorship, or quite simply tapping into and recircuiting local communities' basic material, recycling or waste management systems.

Ecologies in beta

To recap, opening the sources of an architectural project requires both making its designs available *and* re-sourcing its social and infrastructural capacities. Such an orientation to the urban unsettles the material, legal, technical and socio-political conceptions of how we have traditionally come to think of the city as an infrastructural system. Guerrilla architectural collectives struggle to think and open anew what and where the sources of a project might lie while simultaneously standardizing its technical and documentary legacies – as well as devising pedagogies about its technical design systems, legal form, collaborative dynamics, governance mechanisms, materials and resources, and social and political capacities. In such an ecology of open sources there is little time for conventional notions of knowledge, description, epistemology or ontology. Sources constantly re-source themselves, now as materials, now as media, or iconographies, code, language,
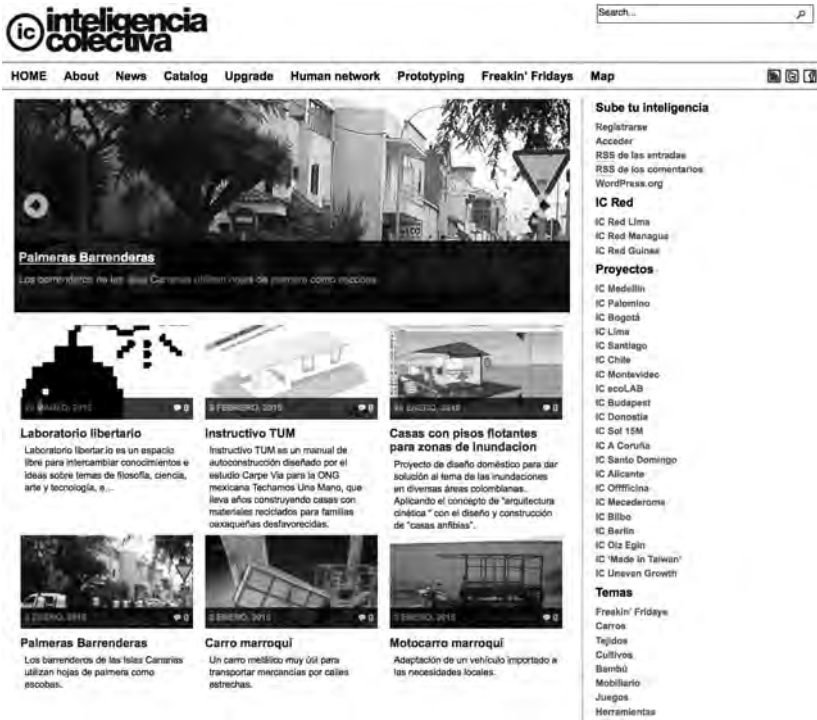
Figure 11.5 Inteligencia colectiva, a public domain self-archival project on do-it-your-self, grassroots, retrofitted architectural designs.
Source: www.inteligenciascolectivas.org/

infrastructures, public spaces, archives, persons, collectives, etc. The ecology is therefore always and everywhere a 'beta' version of itself.

The view of the city as an ecology in beta is exhilarating but can also at times be distressing. There are personal, economic and cultural factors to the sources of distress, not least in a climate of crisis and uncertainty. However, over the course of our work with Basurama and Zuloark we slowly came to realize that the sources of distress were also, in part, conceptual: the view of the city as an infrastructural system is itself stressed by the notion of a complexity in beta. Thus, to circumvent the sources of distress an ecology in beta demands a different ontology of infrastructure. Let us explain.

The revelation that an ecology in beta demands a different ontology of infrastructure came to us at one such moment of distress. Despite their best efforts at developing open-source grassroots projects, throughout 2011–2013 Basurama and Zuloark garnered ever more attention as proponents of a novel regime of urban governance. If at one level theirs was a challenge to the governance of experts, at another it seemed as if they were becoming the new experts. The situation was physically and emotionally stressful because it

demanded from the collectives material and affective resources which sur-passed their own capacities. It soon became obvious to us that this was partly the result of open-source urbanism not having an infrastructural counterpart to the recursive infrastructures of F/OS software projects. As noted above, in software, code works simultaneously as both infrastructure and design. Design and output coincide in the same object. But the urban condition has no pre-given infrastructure wherein open-source designs can self-ground themselves. There is no standardized F/OS infrastructure holding the city together as a larger ontological and epistemic space. In the idiom used earlier, open-source infrastructures stand alone but they have no widespread purchase as urban stances.

It occurred to us then that one way to develop such a stance would be to design open-source infrastructures such that they became immediately part of a wider learnable infrastructure. In other words, where every infrastructural project contributed to enriching, eliciting and widening an ever-growing infrastructure of apprenticeships. What would the city look like, we asked ourselves, as an open-source urban pedagogical project?

In 2013 we sat down with Basurama and Zuloark to design such an infra-structure of apprenticeships. We pondered over the grassroots skills, tools and resources that were proving useful for community projects across the city: did these capacities overlap in places (physical or conceptual), did they mobilize similar or analogous resources, and could they be systematized or built upon? Moreover, could we mobilize the communities themselves in opening all such capacities as pedagogical projects, to have them lay out the sources of their own learning? Using Open Badges technology[2] we designed and developed a digital platform that enabled community projects to warrant visibility to the multifarious ecology of practices they mobilized and deployed in pursuing their own infrastructural projects. We invited them to design their own badges – to have them 'source' their own technical, legal, pedagogical, asso-ciative and political needs – and gave our common infrastructure for urban apprenticeships the name *Ciudad Escuela* (http://ciudad-escuela.org/).

The challenge was straightforward: could such a platform help commu-nities carry out their work better? Could it play a role in legitimizing their practices vis-à-vis local authorities or neighbouring communities? Could it provide a means for communities to learn about their own practices, thereby becoming more robust and sustainable? Take the example of urban commu-nity gardens: would it make sense for Madrid's Network of Urban Commu-nity Gardens to design one or various badges about different aspects of their practice – for instance, the skills or resources assiduously employed or mobi-lized at a garden site? And if it would, what design and pedagogical routes should they take in explicitating and standardizing all such tacit urban knowledge? In the case of Madrid's Network of Community Gardens, the Network convened a series of workshops to better understand the diversity of material, media and social relations shaping gardening experiences across the city. An outcome of such a process has been the production of documentary

materials on the registers, formats and resources shaping the cultural experiences and material pedagogies of community gardening, which led over time to the development of *Ciudad Huerto* (http://ciudad-huerto.org/), an open-source fork of the original *Ciudad Escuela* platform turned now into an infrastructure of urban apprenticeships for community gardening.

We return thus to the point with which we started: why an ecology in beta demands a different ontology of infrastructure. This is an ontology whose sources – its 'natures' – are opened up, expanded to include a capacity for self-learning, indeed, that make of such a capacity for pedagogical exfoliation their 'nature'. Here the nature of infrastructures is displaced from the techno-material to the poetic and social (Larkin 2013). However, this is a social vector that places a premium not in its sources but in its re-sourcing, in its being taken up, learned and reproduced by third parties; in its functioning as an infrastructure of apprenticeships. It is in this fashion that we therefore speak of a shift in the ontological signature of infrastructures: from ontologies that source the open (that source material affordances or capacities, human and non-human assemblages and relations) to open-source ontologies – ontologies that *re-source* the open.

Infrastructures of experiment and infrastructures of apprenticeship

In a recent essay that attempts to sound out a political ontology alternative to capitalism, Philippe Pignarre and Isabelle Stengers employ the idiom 'getting a hold on' to capture the analytical stance that in their view is required of our times (Pignarre and Stengers 2011). 'Getting a hold,' they write, 'designates here struggle situations, when the question is coming to grips with capitalism, but it is also *what allows one to learn*' (Pignarre and Stengers 2011: 19; emphasis added). For Pignarre and Stengers, getting a hold sets in motion a particular type of experimental moment, one that 'suspends all evidence-based argument and demands that we accept the need for experimentation, that is, that we risk being interested by concrete situations in which the precarious beginning of *trajectories of apprenticeship* may be discerned' (Pignarre and Stengers 2011: 22; emphasis added).

The notion of experimentation has recently gained currency among scholars intent in exploring novel and emerging scenarios for political praxis (Jensen and Morita 2015). Much of this work concerns, too, the role that social scientists themselves play in enabling or designing such experimental arrangements. Thus, for example, Helen Verran and Michael Christie have described their partnership with Australian Aborigines in a project that uses digital technologies to curate and assemble Aboriginal natural knowledge traditions (Verran and Christie 2014). This form of 'postcolonial databasing', as they call it, has been carefully designed so as to remain faithful to and accommodate the ontic difference that Aboriginal understandings bring to the very notion of a digital object. This required on the part of Verran and Christie to engage in 'collaborative ontic work' (Verran and Christie 2014: 63), where

some of the prevalent Euro-American assumptions about digital archiving, such as the classificatory and ontological distinction between data and metadata, were suspended and reworked. In their words, this entailed:

> assuming the existence of a third translating domain. This move involves an ontology that is both and neither Aboriginal nor scientific. But this is not a meta-ontology. It is not an ontic domain that supervenes and contains the other two. On the contrary, it is an infra-ontology, an inside connection … effecting among other things a separation of the ontic and the epistemic. Learning how to do this in on-the-ground situations is not easy because it involves working with contradictions in disciplined ways … . The work in this infra-ontological space is essential empirical work centering on metaphysics.
>
> (Verran and Christie 2014: 66–67)

The work of the infra-ontological, then, opens up a space that Verran and Christie describe as an 'experimental metaphysics':

> a framing of issues of difference that takes elements of both metaphysical systems to develop what we might call an ad hoc hybrid translation borderland. It can provide a way to imagine how we might connect in partial, strategic, and opportunistic ways.
>
> (Verran and Christie 2014: 75)

The notion that there are formats of encounter that are conducive to the framing of issues as experimental metaphysics resonates, too, with recent work in social studies of science and technology, where 'experimental ontologies' have been strategically counterpoised to 'empirical ontologies'. According to Steve Woolgar and Javier Lezaun, whereas:

> empirical ontology draws attention to the practices that determine 'what there is' and to how the norms embedded in those practices then grant the world a particular political valence, an experimentalization of ontology opens up (rather than answers) the question of how particular objects come to be invested with normative and political capacities.
>
> (Woolgar and Lezaun 2013: 327)

In this vein, Noortje Marres has offered for example an account of the 'experimentalization' 'by design' of political ontology in an ecoshow home, where the spatial layout, interactive dynamics and material affordances of technologies and interfaces are deliberately invested with specific environmental and political significations (Marres 2013: 423). The ecoshow home functions as an experiment insofar as it enacts a particular 'distribution' of human and non-human force fields (Marres 2013: 428). There is ontological aperture because there is an experimental (socio-infrastructural) distribution.

Let us bring our argument to a close by offering some remarks on this recent coupling of experimentation and political ontology. As outlined in Marres' and Verran and Christie's arguments, the work of experimentation is here fundamentally conceived as an *enabling* technology: an ecology and arrangement of infrastructures that bodies forward new onto-political capacities. The experiment frames and incites possible new worlds into existence. There is a sense, then, in which in these accounts the space and infrastructures of experiment are themselves enabling of political work. It would seem that the relational force field that weaves together human and non-human energies becomes, in its very conjuring as an experimental infrastructure, a driver of enablement.

Yet closer inspection shows us that the liberation of the ontological affordances that these experiments presume often demands the discernment, too, of what Pignarre and Stengers call 'trajectories of apprenticeship' (Pignarre and Stengers 2011: 78 and *passim*). In the quote cited above on the affordances of the infra-ontological, Verran and Christie similarly point out how '[l]earning how to [get the infra-ontological to work] in on-the-ground situations is not easy' (Verran and Christie 2014: 67). It would appear, then, that the work of experimentation sets in fact two simultaneous operations of enablement in motion. First, an ontological aperture, such that a partially novel arrangement and distribution of agencies is born into the world. This is the experimental moment, where a strategically framed distribution is generative of political ontological work. But there is a second form of enablement, which underpins and accompanies the first. We shall call this second moment, a moment of apprenticeship, where it is in fact the opening of a pedagogical process that procures and subtends the form of enablement.

Thus, to go back to our opening vignette, we may read the scenography of *Atlas* as an infra-ontological and collaborative experiment, one that lays out the city's sources of openness. Yet this was an experimental arrangement that was not designed as a space of apprenticeship. As noted, *Atlas* staged a 'theatrical experiment' where the city's sources of radical openness were rendered symmetrical vis-à-vis each other. Like Marres' ecoshow homes, *Atlas* performed its experimental function as a demonstrational device; and like Verran and Christie's postcolonial databasing, it cast itself as a cartography of the city, one that could be read as an 'ad hoc hybrid translation borderland' (Verran and Christie 2014: 75).

We wish to suggest, however, that there might be room for a complementary understanding of how the work of political ontology and liberation gets done. This would entail approaching the field of distribution of human and non-human agencies not just as onto-experimental devices, but as infrastructures for the liberation of apprenticeships. The case of *Ciudad Escuela* offers one such example. Here the work of collaboration looks out for and cares for tending, not only ontologies that source the open, but open-source ontologies too.

Notes

1 We play here with the etymology of the word 'resource', from the French *ressourse, ressourdre*: to rise up again, to spring up again; to recover or recuperate, from the Latin, *resurgere*, to re-surge.
2 The Mozilla Foundation's Open Badges project (http://openbadges.org). Open Badges use free software and open technical standards to enable people to get recognition for learning that happens anywhere, online or offline. Anyone can issue a badge, from traditional higher educational institutions to community organizations or online projects, and it is up to the issuer to decide the achievements that the badge recognizes. In this sense, Open Badges have been praised for the double liberation they bring to pedagogy: first, the liberation or open-sourcing they bring to the very technology that underwrites certificatory standards; but also for the fact that they enable all kinds of learning programmes, on all kinds of topics, to claim recognition.

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