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Waste infrastructures an the invisible city

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Abstract:

Most urban infrastructures, such as water, sewage, electricity or waste management systems are physically beneath the surface of cities, which makes them literally invisible. Even when urban infrastructures are noticeable, their continuous normalized use creates a deep taken-for-grantedness that further contributes to their invisibility. After the act of consumption and disposal, infrastructures such as bins, waste rooms, landfills or incinerators participate in the transformation of the overflow of discarded products into waste. In these infrastructures waste is transported, transformed, monitored, stored, hidden and locked.

Based on the case of waste infrastructures, the paper seeks to explore the opacity *versus* transparency of infrastructures and its implications for more sustainable development. The paper is based on the observations and interviews conducted in waste urban infrastructures in the cities of Gothenburg, Sweden and Managua, Nicaragua.

In the first part, the paper unfolds how most of the studied waste infrastructures worked to make waste invisible. In the second part, the paper examines a number of urban environmental policies (e.g. environmental campaigns, study visits to waste urban infrastructures, recycling containers, or waste collection invoices) that invert the opacity of infrastructures to make waste visible, with the purpose to re-establish the cognitive links between production, consumption, the city and its waste.

Introduction

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Urban infrastructures: mediators in the city of flows

Cities have been defined as a circulatory conduit (Deleuze and Guattari 1997, Sennet 1994, Harvey, 1996 Castell, 1996) of material and energy flows, where material, symbolic and social transformations take place (Kaika, 2005).

Urban infrastructures as power stations, water works or sewage treatment plants are thus the material mediators between nature and cities (Kaika and Swyndeouw, 2000). They are not only carriers that relocate, for example, water, gas, electricity or information flows. They also source, use, transform and metabolize these natural resource flows (Monstadt, 2009). Infrastructures are

therefore both “transformation and distribution points of anthropogenic material and energy flows, acting as nodes in a complex network” (Guy, Marvin and Moss, 2001, p. 4). They are complex socio-technical systems, which embrace beyond the physical infrastructures, organizational practices, institutional arrangements, and socio-cultural meanings (Moss, Guy, Marvin and Medd, 2011; Kaika, 2005). They represent long- term accumulations of finance, technology and organizational and geopolitical power, and therefore imbued with struggles for social and political power (Graham, 2000).

The understanding of infrastructures as mediators, puts the focus on the process of *commodification* whereby socially metabolized goods are turned into commodity or market relations by the mediation of infrastructures (Kaika and Swynedeouw, 2000). The ways in which urban infrastructures are being organized and governed shape the regulation of a sustainable relationship between nature and societies (Monstadt, 2009). For example, challenges in rendering water services more sustainable “relate far more frequently to organizational issues, such as unsuitable legal frameworks, incompatible actor interests, or inadequate economic incentives” (Moss, Medd, Guy and Marvin 2009). Therefore, how urban infrastructures are being organized, matters (Vifell and Soneryd, 2012). Recent institutional pressures for change in water, wastewater, waste management include not just privatization and liberalization of utility service markets but also the tightening of environmental standards (for example those from EU environmental directives), new forms of economic incentives (soft governance instruments at distance), the high cost of network modernization, competition between a growing number of viable technologies, uncertainty over future consumption patterns and overcapacity in some networks (Guy, Marvin and Moss, 2001).

How infrastructures are organized have not only serious environmental footprints. The ‘splintering urbanism’ or infrastructures also can lead to social and spatial inequalities in services provision access, and in the distribution of environmental costs (Graham and Marvin, 2001), through processes of ‘cherry picking’ (Coutard and Guy 2007) or ‘infrastructural bypasses’ (Coutard, 2008).

Susan Star defined infrastructures as being: embedded or ‘sunk into and inside other structures, arrangements and technologies’; transparent to use (‘it does not need to be reinvented each time or assembled for each task’); provides spatial or temporal reach; learned by members or users;

linked with conventions of practice (e.g. household solid waste practices); embodies in standards, built on an installed base of capital and interlocked to other infrastructures; fixed in modular increments; and becoming visible upon breakdown (Star, 1999 p. 381-382).

In correspondence with the last characteristic, the absent of infrastructural flow creates visibility, just as their continuous normalized use creates taken-for-grantedness and invisibility (Star, 1999; Graham and Thrift, 2007). In addition, most urban infrastructures remain beneath the surface of cities or at their fringes, which also makes them literally invisible (Kaika and Swyngedouw, 2000). However, urban infrastructures have not always been opaque. In the 19th century urban infrastructures as water towers, power plants or pumping stations, were icons of progress (Kaika, 2005), until they become materially and symbolically buried in the underground. The invisibility of infrastructures and the work they do in the modern city contributes to masking the social relations through which the translocation, transformation, and commoditization of natural resources takes place (Kaika and Swyngedouw, 2000, p. 121).

Methodology

The analysis of waste infrastructures presented in this paper is based on the narratives collected from two ordinary cities: Managua in Nicaragua and Gothenburg in Sweden. To compare a wealthy city in the global North such as Gothenburg, in one of the wealthiest countries in the world, with Managua, the capital of Nicaragua, the second poorest country of the Americas, might appear methodologically and ontologically inappropriate. However, cities are best understood as ordinary rather than labelling them as Western, third world, developed, developing or global (Robinson, 2006, p.1). This paper argues that it is important for cities in wealthy societies 'to be open to learning from the experiences of poor cities' (Robinson, 2006, p. 141), especially when the differences between one or the other are lessening (Graham and Thrift, 2007).

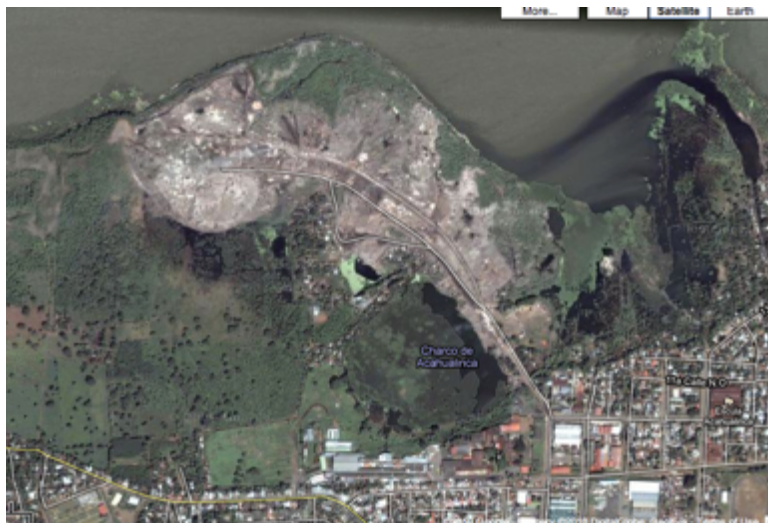
Following the ethnographic work of Star (1999) regarding the understanding of infrastructures, this paper focuses on the reading and 'unfreezing of waste infrastructures' and their taken-for-granted work. In order to do that it performs what Bowker and Star (1999) called an 'infrastructural inversion'. The paper is based on ethnographic observations conducted in some of the strategically situated sites (Marcus, 1995), the sceneries of waste infrastructure, often

backstages (Goffman, 1959): the city dump of Managua, La Chureca and some of its spontaneous settlements, and waste infrastructures in the city of Gothenburg as waste rooms, waste trucks, waste transshipment stations, incinerators and municipal landfills.

Photographs, field notes with observations, personal interviews and document analysis collected as part of two waste research programmes constitute the main source of data. I took the photos in situ, and when returning to my desk after an observation or interview I wrote down my field notes and comments to the photos. What notes we take, and what motive we photograph might say more about us as researchers than about what we observe (Baszanger and Dodier 1997: 14-15), however, the question we ask, to whom, when and where are also formulated by us. As Latour writes, ‘we have taken science for realist painting, imagining that it made an exact copy of the world. The sciences do something else entirely – paintings too, for that matter. Through successive stages they link us to an aligned, transformed, constructed world’ (Latour 1999: 78). Inspired by Latour and Hermant (1989), photos are used as the main data in the paper to illustrate the field of my research.

Rendering waste invisible

Figure 1. Map of La Chureca dump



In Managua, La Chureca was located at the edge of the city, far away from the eyes of most city dwellers, and in particular, the wealthy citizens. Even in the Managua informal settlements, waste was cast out into roads, and riverbeds stored and hid waste, at least from the sight of those who dumped it.

Figure 2. Waste dumped in riverbeds



In Gothenburg most of the waste infrastructures studied worked to hide waste: the container, the waste vacuum system, the waste truck, or the waste incinerator.

Figure 3. Waste vacuum system



In houses equipped with a waste vacuum system residents just need to carry their rubbish bags a few metres (sometimes in their balcony, sometimes outside the apartment in the corridor) open the circular door in the wall and throw it into the pipe whenever necessary. The rubbish bag just disappears. This is one of the technological devices that make waste most invisible. As the company responsible for its installation and maintenance puts it, the vacuum waste collection system is ‘the invisible solution for environmentally sustainable waste handling’ (Envac, 2012). However, residents, hidden by the anonymity provided by the privacy of the waste vacuum pipe or the waste room, sometimes throw waste fragments that are forbidden: either because they do not fit the classification, are too big and can obstruct the pipe, or are hazardous. Once the waste bag is thrown into the pipe it goes to the basement, and it is stored there until one of the municipal waste management company trucks comes to collect it.

Figure 4. Fragments of waste



When the trucks collect waste in containers waste is made visible although only partially, and for those who operate the truck.

Figure 5. Opening the waste container



During my observations in a tour in one of the municipal waste trucks, the driver invited me to open the waste containers and see what it was in them: large amounts of intact food or books that would be soon incinerated. With this gesture, the waste truck driver did express repeatedly his indignation with the waste of resources that day after day he collects with his truck. In Sweden 30% of the food that is produced becomes food waste, as the one that the truck driver was showing (Swedish Waste Management, 2012).

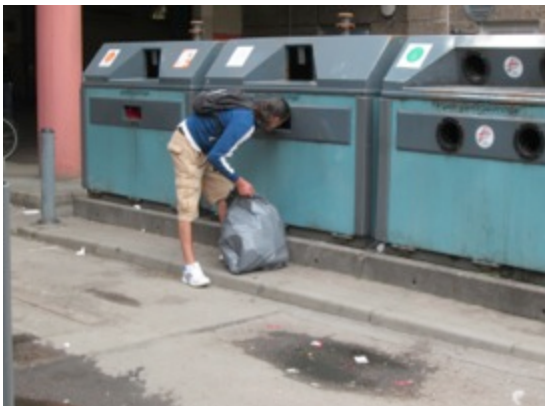
Figure 6. Waste container divers.



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However, a small fraction of this food is rescued illegally from waste containers in front of food shops by homeless and other organized social groups as the ‘container-divers’ (Faktum, January 2011). Container divers searching for food claim that despite the illegality of their actions “what is unethical is to cast valuable food as waste” (Faktum 2011)

Figure 7. Scavengers in Gothenburg



In a similar fashion, during some of the waste truck stops, we also met informal waste collectors that recovered recyclables from the containers. According to one of them, illegal collectors of metal cans or bottles like him can turned easily into more than 50 Euros per day, or 600-700 Euros per month.

Figure 8. Crane operators and the crane at waste incinerator



When the trucks dispose of mixed waste at the incinerator, it is, again, visible although only partially, since the mountain of waste at the bottom of the bunker is made up of a mix of heterogenous materials and fluids. Crane operators can however discern rich and poor waste-fuel. Eventually, they can salvage objects like bicycles from the oven.

The exact composition of waste (e.g. the pollutants populating the combustible waste) is still a mystery even for one of the ‘world waste-to-energy plants’ like the waste incinerator in Gothenburg. As I learnt in one of the lectures held at the incinerator facilities with other waste management researchers:

‘How does our fuel, our waste, look like, what are their properties? We did not know what the waste, what the fuel contains. we knew very well what comes out of the chimney and what comes

out to the water, but did not know what waste contains'. Municipal waste management researcher and officer during one lecture at incinerator facilities with waste management PhD students.

The waste incinerator is presented as one of the most efficient infrastructure to make waste disappear, reduced into slag, nanoparticles and a few CO₂ emissions (much less visible). Reducing volume and transforming its material state represents the culmination of the process of dematerialisation and invisibilisation of waste. The waste incinerator was describes as a 'dioxin sink' of society, as a metaphor of an efficient infrastructure to make waste disappear.

'Some of us say that waste incineration is a low point of dioxins ... it is a place where we destroy more dioxides than are formed. There are dioxins in society, we are taking to the incineration plants and dioxin is destroyed by the heat in the incineration process, Actually less emissions come out from the chimney than what it came in with waste. The question is that the waste incinerator is a dioxin sink in society. Actually, there is less coming from the chimney than coming from waste.' Waste management researcher and officer during one lecture at incinerator facilities with waste management PhD students.

Rendering waste visible

However, during my observations I could also identify social and policy practices that rendered waste visible in both cities.

Figure 9. Collecting waste in informal settlements in Managua



In the informal settlements in Managua, householders themselves directly transfer their waste to the waste collectors. The waste collection system is carried out with the sound of a bell hanging from the waste municipal trucks or the whistle used by the cart men (Zapata Campos and Zapata,

2013). In this way they announce to the residents that the waste collection service is approaching their homes. Residents then go out from their houses and dispose of their waste directly to the waste collectors.

Figure 10 Emptying the waste bag.



Only a reusable bag separates the waste householder from the waste collector. Waste becomes visible to the eyes of everybody when the collector empty the bags into the carts or the trucks, exposing the contents and returning the bag to the householder to be reused for the next service. In these barrios, most wastebags are emptied and reused. Waste is visible to the dwellers of the informal settlements but continues being invisible and odourless for the rich city dwellers that employ domestic staff to deal with their waste.

Figure 11. Direct payment.



In the barrios where waste cooperatives have started collecting household solid waste, the payment for the service is made at the same moment the service is provided and directly to the waste collector who provides the service. The absence of intermediaries in the payment for the service also contributes to visualize its costs. Unlike the problems experienced by the waste collection services run by the city of Managua, where less than 30% of the householders pay for it. The exchange of waste is evident, direct, when it occurs with fewer intermediaries and with more transparent mediators.

Figure 12. Riverbanks with waste.



When waste is not collected by any service, is illegally dumped and it also remains visible in the river banks, not for those that had dumped waste, but for those that live in their proximity.

Figure 13. Waste recycling container



In Gothenburg, a number of waste management and political practices have contributed to render waste, visible. For example, recycling containers where waste was separated succeeded in making visible the different materials and value still contained in waste. The containers are designed to transform waste “from ambiguously, undefined things into named, understood, transparent and performative materialities” (Corvellec and Hultman, 2013, p. 145). To make waste visible implies to create new categories, to label and to make materials distinguishable and understandable (Bowker and Star, 1999). These recycling containers are artefacts that are designed to make us look in our waste and identify, materials, classify them and name them.

Waste trucks painted with the figurative waste they transported travelled daily through the city of Gothenburg, symbolically opening up their hidden and inaccessible contents for ordinary citizens to see; but safely: without violating the privacy of what they transport not putting in risk its value or the public health.

Figure 15. Waste collection invoice



Since 2011 a new waste collection invoice based on the weight of the waste produced by households has been introduced. The invoices sent to residents detail how much residents how

much waste they throw, of what categories (mixed and food waste) with the corresponding cost. The purpose is to encourage people to separate their food waste from unsorted waste and, more generally, to recycle more. The municipal department in charge of waste management presents invoice as a way for residents to assess “in black and white how green they are” (Göteborgs Stad Kretslopp, 2010).

Figure 16. Study-visit to waste incineration facilities.



Scholars visited the waste incineration facilities, and were allowed to see and smell the material impacts of their consumption practices.

Figure 17. Ullevi football stadium filled with waste.



And environmental campaigns, such as simulating the Ullevi football stadium in Gothenburg filling up with rubbish, also attempted to show the volume of waste produced in the city.

Discussion: rendering waste invisible and visible and implications for a sustainable development

1. In high modern cities as Gothenburg, with a sustainability record with regard to its waste management infrastructure network, waste is kept out of sight since the very moment in which their producers dispose of it: in dark bags, in closed containers, locked waste rooms, waste trucks and bunkers. Waste infrastructures are opaque (Star, 1999): a black box where the exact content of waste is hidden from the outsiders' gaze.

2. The question of where waste is hidden, and from whom brings up issues of power. Waste is hidden in waste infrastructures from wealthy and ordinary citizens, but is materially visible to, for example, scavengers, slum dwellers and other less well-off urban communities. Issues of environmental justice emerge in disclosing how deprived communities suffer the material effects of waste, waste infrastructures and even waste collection services (Bell and Sweeting, 2013). Or how the disposed and paupers surface from the city underworld or the city edge to extract the value left (as recyclable materials, but also as food or reusable objects) in what has already been cast out (Fahmi and Sutton 2013). The sharp contrast of the heteropia of waste in the city and the utopia of the clean, sanitised and well-functioning city reveals the contradictions of a sustainable urban development, of social and environmental justice in the city (Zapata Campos, 2013). The waste narratives from Gothenburg and Managua confirm that if you 'Study a city and neglect its sewers', or in this case, its waste urban infrastructures, 'you miss essential aspects of distributional justice and planning power (Latour and Hermang, 1998)' (Star, 1999, p.379).

3. Despite waste infrastructures are opaque, eventually waste (or some fractions/glimpses of waste) become visible to those working within these infrastructures once waste is uploaded. This is also how I could follow waste and its transformations during my fieldwork and observe waste as only those who have access to these infrastructures do. The waste truck driver sees every day

fragments of waste when the containers are emptied in the truck and compressed. Similarly, the crane operators at the waste incinerator learn to discern different materials within the mountain of waste stored in the incinerator bunker. During my observations, waste operators working within these infrastructures for whom waste becomes visible were outraged. For those who can see waste as it is, as an overflow (e.g. when the truck driver showed with indignation the amounts of foodwaste in containers), the linkage between city and nature, consumption and waste, is visible / acknowledged. In other words, the contemplation of waste, its visibility, shows our unethical and unsustainable consumption practices.

4. The opacity and inaccessibility of waste urban infrastructures, as of those studied in this paper, contribute to obscure the social relations and power mechanisms through which the urbanisation of nature takes place in the city (Kaika, 2005) and along with the de-naturalisation of waste. Waste urban infrastructures are material mediators between nature and the city, where the flow of deterritorialised goods, materials and energy entering the city enact multiple transformations, finally becoming waste (Deleuze and Guattari, 1997). Or, differently expressed, making waste infrastructures invisible and inaccessible obscures the link between production, consumption and the disposal of waste. As a consequence, city dwellers (for whom waste is hidden and inaccessible) find it difficult to couple their consumption habits with the growing mountain of waste – waste just disappears efficiently from their bins, shelves, fridges, drawers and wardrobes are empty again, ready to welcome new objects of consumption and renewal, just as in Italo Calvino's city of Leonia.

Therefore, one of the dilemmas facing the governance of cities towards more sustainable urban transformations is to what extent the heterotopic infrastructures that make waste efficiently disappear can paradoxically contribute to hide the steady growth of the overflow of waste (Zapata, 2013). This is, how efficient infrastructures, even with a sustainability record, contribute to hide the consequences of the consumption and discard society.

5. The practices observed at the city of Gothenburg aimed to unlock the waste infrastructures by visualising materially or symbolically the impacts of consumption practices. Unlike Managua's informal settlements, in high modern cities as Gothenburg, a myriad of human and non-human

intermediaries stand between the consumption, production of waste and collection and treatment of waste: waste rooms, opaque waste bags, invoices. The long chain of intermediaries also contributes to hide the link between consumption and the production of waste. By making some of those intermediaries more transparent (waste trucks or invoices) and visible the cognitive links between nature and society can be re-established. Furthermore, these practices show what classifications can do (Bowke and Star, 1999). When a new waste category is created, there are power dynamics behind it. For example, a new waste fragment implies the existence of creation of a market for this waste fragment that becomes a commodity. To make waste visible implies to create new categories, to label and to make materials distinguishable and understandable (Bowker and Star, 1999). How these infrastructures are designed will make a difference on how we look in our waste, and what materials we identify according to these categories.

To conclude, the governance of waste towards more sustainable urban transformations faces the challenge of opening up waste urban infrastructures, re-establishing the cognitive links between production, consumption and waste, breaking new roads towards 'wasting less' regimes (Corvellec and Hultman, 2012) and transforming these opaque infrastructures into transparent and unlocked containers of our outcasts.

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