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Technifying Public Space and Publicizing Infrastructures: Exploring New Urban Political Ecologies through the Square of General Vara del Rey

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Abstract

The aim of this article is to explore new ways of integrating technology, nature and infrastructures into urban public spaces. This is done through a case study, the design of General Vara del Rey, which is offered here as a model to explore a novel urban political ecology that calls into question dominant definitions of public spaces as self-contained sites operating independently of natural and infrastructural spaces. Through the double movement of 'the technification of public space' and 'the publicization of infrastructures', the square aims to rethink the political ecology of urban public spaces by enabling the effective incorporation and participation of infrastructural and natural elements as active actors into the public and political life of the community. It is argued that the transformation of infrastructures into fully visible, public and political agents provides a useful model to address the growing proliferation of infrastructural and technological elements onto contemporary urban surfaces and to open up the possibility of new forms of civic participation and engagement.

Introduction

The illustration shown in Figure 1 is one of the most well known and powerful examples of a novel way of conceiving urban space that emerged around the second half of the nineteenth century. In this conception, urban space is organized around a clear discontinuity between, on the one hand, public urban surfaces, defined as the spaces of human exchange, commerce, leisure and domesticated nature, and on the other, an invisible subterranean city populated by different technological inhabitants, like water pipes, wires, conduit pipes, passages, culverts, as well as water and energy flows. Historically, the emergence of this segregated urban system can be seen as a logical response to the problems that had afflicted European cities after the first and second industrial revolutions. The rapid development of heavy industries and the massive flows of rural migrants had resulted in dramatic urban growths that transformed urban centers into chaotic, heavily polluted and insalubrious environments. This is the time of the Big Smoke in England, of endemic infectious diseases, like cholera, typhus and tuberculosis, decimating urban populations, and of the social revolts that repeatedly swept European cities between 1820 and 1848. It is against this backdrop of insalubriousness, uncontrolled urban growth and social unrest that reformers like Haussmann posed the ideal of a new model of urban cohesion based on a peaceful integration of nature, technology and society in a renewed, well ordered and sanitized urban environment.

Haussmann's *Plan for Paris* is not only important because it helped to develop a novel conception of urban space that sought to 'regularize the disordered city (Choay, 1969:

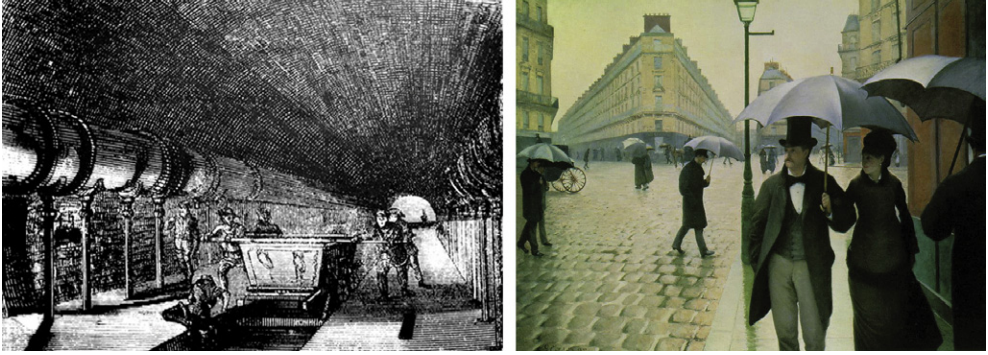


Figure 1 Haussmann's renovation of Paris: left – 'Grand Égout Collecteur', engraving, 1863 (source: Joanne, 1870: 368); right – 'Rue de Paris, Temps de Pluie', Gustave Caillebotte, oil on canvas, 1877 (© Arts Institute of Chicago, reproduced with permission)

15), but also because it inscribed and enacted a novel urban political ecology, that is, a new way of conceiving, organizing and governing the relations between the different inhabitants of the city. As we define it here, urban political ecology starts with the recognition that the inhabitants of the city are not only social (e.g. individuals, collectives, institutions, etc.), but also natural (e.g. physical environment, climate, etc.) and technological (e.g. infrastructures, architectures, etc.). From the perspective of urban political ecology, therefore, the traditional concern of political theory with the governance of human relations is expanded to include the natural and the technological into the governance of the city (Graham and Marvin, 2001; Robbins, 2004; Kaika, 2005; Keil, 2005; Swyngedouw, 2006).

Haussmann's *Plan for Paris* represents a key event in the development of a novel political ecology, of a new regime of cohabitation, based on the separation of the human, natural and technological inhabitants of the city into two distinct spheres of governance: *the political sphere* of urban surfaces designed by architects and urban planners, governed by politicians, and open to public debate and accountability; and a largely invisible '*subpolitical*' sphere¹ hosting multiple cities (hydropolis, informational city, electropolis) engineered by different forms of expert knowledge and operating largely beyond the democratic control and accountability of citizens (see Figure 2).

The development of this urban political ecology must be seen in conjunction with the emergence of a specific technology of governance centered on the attempt to increase the moral and political control of the population through the rationalization of space (Foucault, 1977; Scott, 1999). Indeed, many urban reformers of the day saw urban planning and architecture as powerful instruments for the design of new moral and political orders. This is evident in Haussmann's *Plan for Paris*, which was explicitly designed 'to regularize the disordered city, to disclose its new order by means of a pure, schematic layout which would disentangle it from its dross' (Haussmann, in Choay,

1 Our use of the term 'subpolitical' differs from Ulrich Beck's (1997) original use, which Beck employed to describe all those political forms located outside formal institutions of the nation state. As Holzer and Sørensen (2003: 80) point out, Beck's subpolitics is mainly about 'the re-politicization of areas outside the iron cage of bureaucratic politics in the face of new challenges brought about by the process of reflexive modernization'. While we agree with Beck that politics cannot be restricted to the formal structures of the state, we differ in his (tacit) restriction of politics to human agents. In this article, we extend Beck's use of the term 'subpolitical' to include all those technological, natural and material elements and processes that have been traditionally excluded from the formal sphere of politics, but which nonetheless act as 'a tacit, *constituting force* in the organization of political collectives' (Marres and Lezaun, 2011: 491).

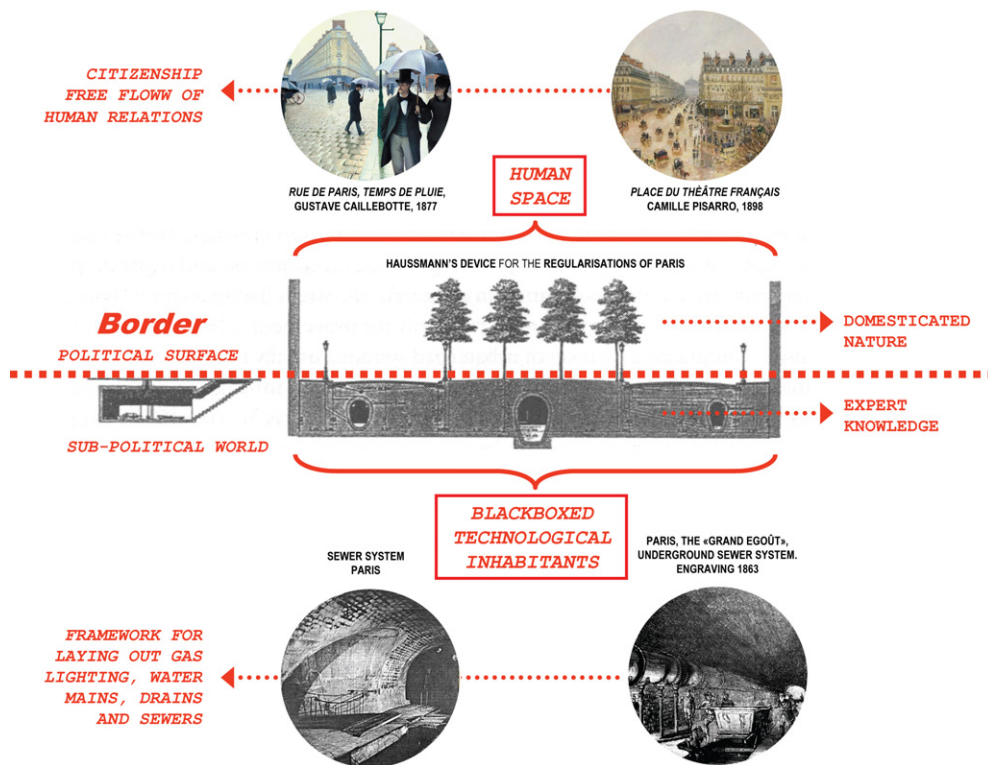


Figure 2 The modern urban political ecology

1969: 16) and to enable, in so doing, a greater and more efficient police and military control over the city (Jordan, 1996; Weeks, 2000: 52).

This Haussmannian urban political ecology, based on the segregation of the city into two distinct functional compartments, has constituted a powerful normative ideal to organize and govern the relations between the different inhabitants of the city. Indeed, much of the urban planning between the nineteenth century and the first half of the twentieth century can be seen as a prolonged effort to achieve the Haussmannian ideal of sanitized, well ordered, public urban surfaces through the domestication of nature and the ‘blackboxing’ of large infrastructural networks (Fishman, 1982; Le Corbusier, 1987; Jacobs, 1996; Gandy, 2002; Hall, 2002; Kaika, 2005; Desfor and Vesalon, 2008). As the twentieth century marched along, water and waste systems, communication networks, energy and industrial infrastructures were gradually buried underground or slowly displaced to the peripheries of the city, as nature was integrated into urban centers in the form of carefully domesticated environments designed to create large ‘pleasure grounds’ for the rapidly developing urban bourgeois population (Cranz, 1982).²

Needless to say, the domestication of nature and the blackboxing of infrastructure resulted in a radical improvement in the salubriousness and livability of urban environments. The gradual substitution of small and fragmented infrastructural networks by large-scale, centralized and integrated infrastructures not only contributed to the liberation of great swaths of urban space for different activities, like leisure, recreation,

2 An exception to this rule are transport and telecommunication infrastructures, which not only remained visible over the twentieth century but were quite often fetishized and spectacularized as part of different political projects (Caro, 1974; Larkin, 2008).

consumption and commerce, but also enabled the gradual universalization of access to basic services like water, electricity or the phone and, through them, to the standardization and cohesion of urban spaces and populations (Graham and Marvin, 2001). However, and despite the achievements of this dual model, it has become increasingly evident over the last decades that this Haussmannian political ecology has outlived its usefulness as a way of conceiving and organizing contemporary urban life. The unrelenting effort to bury, integrate and standardize infrastructures has been outpaced by a number of interrelated factors, like the unprecedented growth of urban populations, the ever-growing needs of capitalist expansion and its associated demands for greater interconnection between markets and urban centers, the seemingly unceasing revolution in communication, information and energy technologies, or the rapid motorization of culture with the subsequent need for large-scale transport infrastructures (Castells, 1992; Sassen, 2001; 2002; Altshuler and Luberoff, 2003; Featherstone *et al.*, 2005; Urry, 2007).

As a result of the ever-growing demands emerging from these interrelated processes, some of the infrastructures that were once confined to a subterranean or peripheral existence have slowly re-emerged from the ground, invading and reconfiguring contemporary urban landscapes. Thus, the idyllic landscapes of urban civility imagined by Haussmann — perhaps nowhere better exemplified than in the Parisian boulevard — are giving way to new ‘infrastructurescapes’ defined by new formats of infrastructural visibility and a new economy of the visible. The development of large-scale transport networks and hubs (Flyvbjerg *et al.*, 2003), the creation of technological and informational hotspots or the emergence of new forms of ‘green urbanism’ (Swilling, 2011) are giving way to novel forms of infrastructural monumentality that are reconfiguring the material and symbolic fabric of the city.

It is our contention in this article that the abrupt irruption of the subpolitical world of infrastructures onto urban surfaces is not merely transforming the aesthetic or symbolic landscape of contemporary cities but it is also giving way to a novel urban political ecology. By actively reshaping urban environments, creating new borders, channeling and regulating the flows of exchanges between people, values, things and the built environment, contemporary infrastructures have become powerful elements redefining the ways in which urban spaces and populations are constituted, connected and disconnected. The development of mega-transport projects connecting global hubs and users, the rapid emergence and proliferation of differentiated, small-scale, privatized and customized infrastructures catering for specific customer needs — like gated communities with their own infrastructural networks (De Duren, 2006; Glasze, 2006) or hyper-connected financial centers with exclusive access to communication and transport infrastructures — are producing increasingly segmented urban spaces and segregated publics with unequal access and rights to the city (Harvey, 2003; Mitchell, 2003). In this process, as Kirkpatrick and Smiths (2011: 480) point out, ‘many cities have ceded many of their infrastructural responsibilities, and a significant amount of authority, to extra-local entities’ thus locating infrastructures further beyond public control and accountability (see also Siemiatycki, 2005; Torrance, 2008; Mustafa and Reeder, 2009). As a result of these developments, the old Haussmannian ideal of homogenous urban spaces and cohesive publics unified by large-scale integrated infrastructures is being rapidly replaced by a novel urban cartography defined by new physical, symbolic and socioeconomic boundaries and uneven forms of citizenship. This is perhaps nowhere as evident as in the rapidly growing urban environments of the global South where infrastructures have become crucial elements in the reproduction of highly segregated spaces of privilege and wealth (Silva, 2000; Gandy, 2006; Kooy and Bakker, 2008; McFarlane, 2008; Mustafa and Reeder, 2009; Dupont, 2011).

In this context, infrastructure planning and provision have resurfaced over the last decades as key sites of public political debate and contestation (Altshuler and Luberoff, 2003; Flyvbjerg *et al.*, 2003). The crisis of the Haussmannian model makes it increasingly urgent to rethink contemporary urban spaces alongside a novel political ecology, one that is able to deal with the challenges posed by the new technological and

infrastructural inhabitants redefining contemporary urban landscapes and politics. This article aims to be a first step towards imagining a novel urban political ecology emerging from the ongoing process of 'technological and infrastructural invasion'. We contend that the 'invasion' of infrastructures and technologies should not be seen in purely negative terms, as an inescapable neoliberal process leading to urban fragmentation, a widening gap in socioeconomic inequalities and to increasingly differential forms of citizenship (Graham, 2000; Graham and Marvin, 2001; Torrance, 2008; Swilling, 2011). Although these negative processes are undeniably taking place, we contend that the new formats of infrastructural visibility and the development of new technologies *also* offer an opportunity to think anew the integration of technology and infrastructures into the city as well as its relationship with public and natural spaces. Specifically, we claim that these developments open up the space for a novel urban political ecology, one whose main concern is not to domesticate, control or blackbox natural and infrastructural elements, but rather to enable their effective incorporation and participation into the public and political life of the community. As we argue, the transformation of the subpolitical worlds of infrastructures and nature into fully public and political worlds not only offers a new understanding of urban space but also the possibility of new forms of civic participation and engagement.

We approach this novel political ecology through the lenses of architectural design, which over the last century has become one of the fundamental tools responsible for organizing the 'invasion' and incorporation of infrastructures into the surfaces of the city. As we argue, the eruption of infrastructural worlds onto urban surfaces demands an urgent repoliticization of architectural design. For the most part of the past century, the architectural design of public spaces has been largely confined to a merely cosmetic or ornamental function dealing with the decorative aspects of public surfaces and urban furniture, thereby abdicating to engineers the control over the increasingly vast subterranean world of infrastructural technologies. In so doing, architects have acted as silent witnesses, wittingly or unwittingly helping to secure and reinscribe the separation between culture, nature and technology implicit in Haussmann's modern political ecology. There is a need for another architectural program, one that takes the integration and articulation of nature, culture and infrastructure into new hybrid urban neighborhoods as its main design and political problem (Swyngedouw, 1996; Gandy, 2005). The first necessary step towards this new architectural program is to reclaim infrastructural and natural elements as *sui generis* architectural elements in the design of public spaces. We exemplify how this can be done through a particular urban intervention: the design of General Vara del Rey, a public square in the center of Madrid's historic district, designed by the architectural office Elii.³ The aim of the article is not to provide a thorough description of this project, but to offer it as a possible model to rethink contemporary urban political ecology. More specifically, we discuss the design of this square as a possible model for reimagining urban public spaces by bringing the subpolitical world of infrastructures and nature into the broad light of public urban surfaces. We use *Elii's* model to explore how to disrupt the modern separation between infrastructural spaces and political surfaces through two distinct but symmetrical operations, namely: *the technification of public space* and *the publicization of infrastructures*. The technification of public space is described here as the process of recovering the social, political and aesthetic capacities of natural and infrastructural elements by turning them into active elements in the design and composition of public urban spaces. This process, we argue, must be accompanied by a symmetrical

3 Elii was established in 2006 by Uriel Fogu , co-author of this article, Eva Gil and Carlos Palacios. Its activity has focused on the development and construction of architectural and urban projects dealing with public space, infrastructures, industrial construction, ephemeral architecture and exhibition design (for more information, see <http://www.elii.es>). This article emerges from a series of critical discussions held between the two authors about the potential contributions that the design of General Vara del Rey may make to contemporary urban and architectural theory.

publicization of infrastructures aimed at replacing the traditional understanding of infrastructural and natural processes as ‘matters of fact’ located outside the realm of public discussion with an understating that deals with them as *matters of public concern*; that is, as subjects open to public scrutiny, discussion and accountability (Latour, 2004a; 2004b).⁴ The article concludes with a call to rethink architectural design as a form of material politics rather than as a simple material means for politics. As we claim, the political valence of design does not reside in its ability to spatialize and materialize political programs and ideologies, but in its capacity to generate spaces of political discussion and civic engagement.

Technifying public space: from containers to interfaces

General Vara del Rey is a well known square in Madrid, both for its strategic location in one of the city’s historic districts and for becoming, each Sunday, one of the central sites of El Rastro, Madrid’s largest and most populous flea market. The square constitutes an archetypical example of contemporary urban public spaces and a powerful illustration of the kind of pressures these spaces face in most contemporary urban environments.

General Vara del Rey has become over time a patchwork of different architectural styles, functions and memories. Initially, the square was designed as a private space belonging to the slaughterhouse that once existed in the area and was later transformed into a public space. The contemporary square emerged in 1928, when it was separated from the nearby Plaza de Cascorro. In its present form, the square is organized around a central recreational space, punctuated by some trees, benches and lampposts. With the exception of Sundays, when the square becomes a bustling site of economic and social transactions and exchanges, the square’s main function is to offer a restful place to seat, talk or take shelter from the heat during Madrid’s sultry summer months. However, and as is the case with many public spaces in large urban centers, the untroubled environment the square aspires to create is constantly thwarted by the incessant rumbling of traffic that clogs the narrow cobbled streets surrounding the square, as well as by the scores of cars that each day invade its perimeter in search of a much-coveted parking spot. The square can be thus characterized as a ‘fragile’ public space, increasingly confined and endangered by the unrelenting demands and growth of the infrastructural and transport networks of the city.

In 2007 Madrid’s city council launched an ambitious plan called *Proyecto Madrid Centro*. The first phase of this plan consisted of the elaboration of a strategic plan commissioned by the city council to different architectural offices to modernize the highly congested and increasingly pauperized historic district of the city and to define the basic guidelines for its future development. Elli was selected to elaborate a *Strategic Plan* to explore the integration of photovoltaic energy in the city. Elli’s plan proposed transforming the entire historical district into a huge energy infrastructure through the massive incorporation of solar panels. In 2009, the city council commissioned Elli to put into practice some of the main ideas proposed in this plan through a small pilot project in General Vara del Rey that would explore the integration of smart technologies into the historic district of the city.⁵

Elli’s proposed plan for General Vara del Rey aimed to challenge the traditional Haussmannian understanding of public spaces as spatial ‘containers’ for human

4 Although we borrow these terms from Latour (2004a; 2004b), we employ them in a slightly different way. Specifically, while Latour defines ‘matters of fact’ as those facts established by reference to an incontrovertible nature, we understand them here as those tacit and commonly accepted truths that organize our daily life without ever entering into political debate and scrutiny.

5 For further information and images, see O37 PNS (Premium Network Square) General Vara del Rey at <http://www.elli.es/eng/index.php?/work/O37-pns-general-vara-del-rey/>

interaction, debate and exchange. This model has traditionally defined squares as key elements for the everyday civic life of a participatory democracy, as well as powerful sites for the representation of public demands and for the articulation of different publics (Low, 2000). Following this ideal, architectural interventions have been focused for the most part in attempting to construct pure and self-contained 'social' spaces by eliminating or domesticating all those infrastructural and natural elements that could interfere with the processes of human interaction through which publics are constituted and mobilized. This understanding of public spaces as empty 'containers' is evident in the design of many contemporary urban public squares, which tend to be organized around large voids in which infrastructural and natural elements are normally reduced to merely functional or decorative functions or are blackboxed into invisible infrastructural spaces.

General Vara del Rey represents Elii's attempt to move away from the hegemonic understanding of public spaces as self-contained spaces operating independently of natural and infrastructural spaces. The aim of this project, however, is not so much to criticize this traditional model, but to extend the existing repertoire of public squares in ways that enable the public representation of some of the elements that have been typically neglected from traditional public spaces, like nature and infrastructures. To achieve this, Elii took as its starting point a particular 'sociomaterial' understanding of the public that has been developed over recent years in different fields, like sociology, social studies of science, political theory or geography (Barry, 2001; Latour, 2004a; Latour and Weibel, 2005; Law and Mol, 2008; Bennett, 2009; Braun *et al.*, 2010; Lezaun, 2011; Marres and Lezaun, 2011). This body of work has emerged as a powerful reaction to those traditional understandings that have sought to describe publics as a simple collection of human actors, discourses and practices (Arendt, 1998; Habermas, 1991). As the proponents of this sociomaterial view argue, the traditional equation of publics with people has unduly relegated material, technological and natural elements to extra- or subpolitical spheres (Serres, 1995; Marres and Lezaun, 2011). Thus, in contrast to traditional 'anthropocentric' understandings of the public, the proponents of this sociomaterial view foreground the constitutive role that different materials play in constraining, allowing and informing the ways in which publics are drawn together and separated. In this view, therefore, publics are heterogeneous constituencies of human, technological and natural elements, rather than a simple collection of human actors, actions and discourses. Publics, it follows, cannot be disassociated from the specific material and natural environments, technologies and infrastructures in and through which they are constituted and mobilized, for without them, they would be reduced to a ghostly, spectral existence.

This sociomaterial approach not only offers an opportunity to redefine dominant notions of the public in philosophy and social sciences but also opens up a different course of action for the architectural design of public spaces. Contrary to the Hausmannian program of purification, and its attempt to produce and secure the borders of the public sphere against infrastructural and natural worlds, this sociomaterial view invites us to imagine a radical process of technification that reintegrates into public life those elements hitherto relegated to the extra- or subpolitical worlds of nature and infrastructure. This process of technification, however, should not be understood as a simple process of 'undoing' the Haussmannian model. That is, by technification we do not mean simply resurfacing and scattering over urban surfaces those natural and technological elements that had been hitherto excluded from them. Such a process would merely reproduce and exacerbate the negative effects of the infrastructural invasion affecting many contemporary urban public spaces. Nor should this process of technification be understood as another exercise in vacuous high-tech architectural rhetoric (Solà-Morales, 1996). As we understand it here, this process of technification constitutes an opportunity to articulate a different political ecology: a novel regime of cohabitation that conceives of the city as *single* sociotechnical continuum (Kaika, 2005), rather than as a space composed of different spatial registers

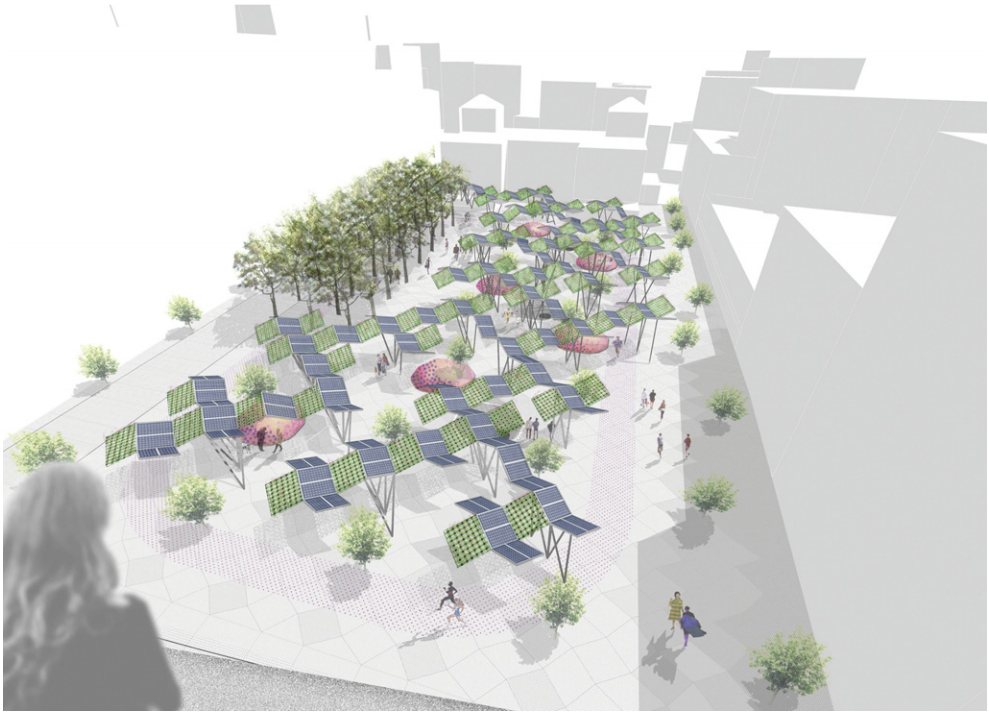


Figure 3 P.N.S. (premium network square) General Vara del Rey, general view (design by Elli, reproduced with permission)

operating according to different logics of expertise and governance. Thus, the paramount question is no longer how to separate, contain or ‘blackbox’ natural or infrastructural elements, but how to integrate them as fully fledged participants into the constitution of public space as well as to explore the new conditions of citizenship this integration entails. General Vara del Rey constitutes an attempt to respond to this question.

The main idea guiding the design of Vara del Rey (see Figure 3) was to develop a project that made it possible to reintegrate into public life different infrastructural processes like energy production and water collection, while retaining the usability of the square for humans. To accomplish this, Elli proposed a project in which different technological and natural elements would have to perform three distinct tasks in the square, namely: to establish a continuity between infrastructural, natural, socioeconomic elements and processes; to create a regime of collaboration and coproduction between these elements and processes; and to establish a livable and comfortable space for human users. Let us explore each of these tasks in detail.

Continuity and redistribution

The first of the tasks entrusted to these different devices would be to establish a spatial continuum between traditionally separated infrastructural, natural and public spaces and functions (Kaika, 2005; Swyngedouw, 2006). To do so, infrastructural processes, like energy production or water collection and distribution, should take place in the public space alongside other social functions, like recreation or commerce. To accomplish this, the square will be populated by a series of hybrid urban trees equipped with a combination of photovoltaic panels and grid-tie inverters that will produce energy by

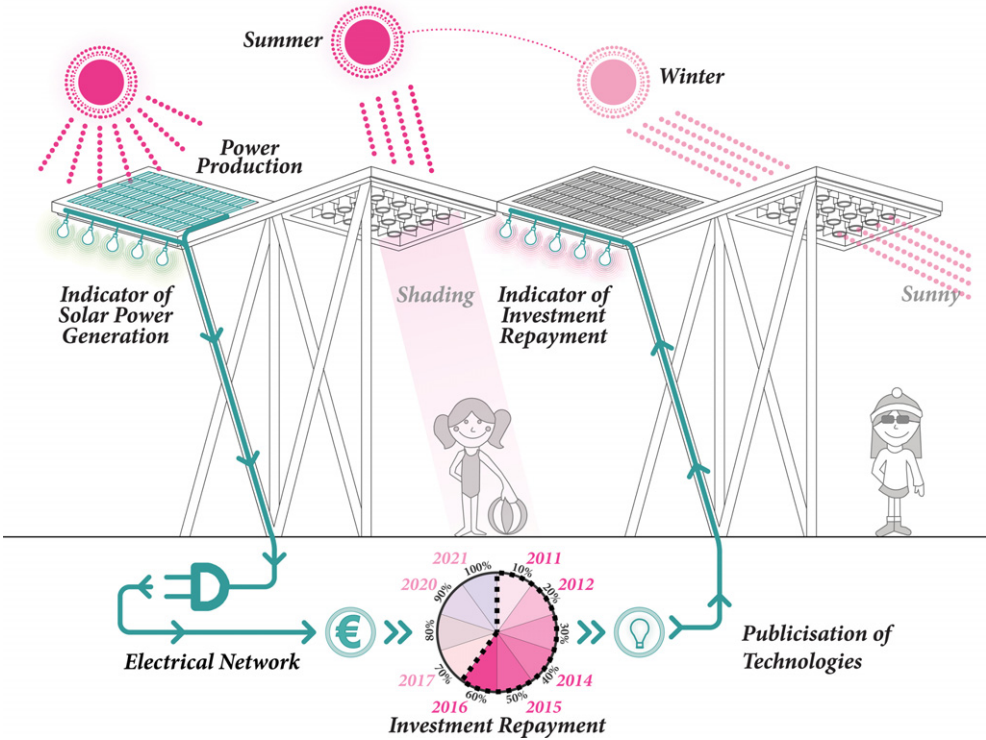


Figure 4 The working logic of urban trees at P.N.S. General Vara del Rey (design by Elii, reproduced with permission)

converting DC into usable AC (see Figure 4). In addition to these infrastructural functions, the hybrid trees will be equipped with different recreational artifacts, like swings, slides, carrouzels and a wide array of exercise devices that will transform these infrastructural devices into recreational devices.⁶

Besides the hybrid urban trees, a network of small water hills covered with vegetation and scattered all around the square will collect, recycle and redistribute rainwater. A specially designed permeable pavement will help in this process by allowing rainwater to filter through it and enrich the soil. The collected rainwater will be treated and distributed by the hybrid urban trees to sustain the biodiversity of the square (see Figure 4). Through these devices the square emerges as a sociotechnical continuum in which different technological elements like DC/AC converters and photovoltaic panels, and natural elements like solar paths and solar radiation, will be woven together with different social processes, like energy consumption or recreation, thus making impossible any reading of the social, the natural or the technological *per se*.

Collaboration and coproduction

The second task entrusted to these devices will be that of creating a regime of collaboration and coproduction between socioeconomic, natural and infrastructural spaces. One of the ways in which this will be accomplished will be through the collaboration of natural and technological elements in the infrastructural network of the

6 For further information about these hybrid urban trees, see <http://www.elii.es/eng/index.php?/work/048-urban-trees/>

city. Specifically, the task of the square will be to invert the parasitical relation which has traditionally defined public spaces as passive consumers of infrastructural resources. General Vara del Rey will invert this relation by transforming the square into a 'productive agent' actively contributing to the infrastructural fabric of the city. The project proposes to use solar photovoltaic power to cover the cost of the construction works as well as the future maintenance of the square. Thanks to the photovoltaic panels installed on the trees, the square will produce an average of 57,973 KWH per year, yielding an average of €748,836 over the first 25 years.⁷

Besides this energy production, and thanks to the collection of rainfall, the square will be able to get an 'off-the-grid' water supply which will enable it to become independent from municipal water supply during the cold months of the year. In this way, the square will help to economize public water consumption in a city subjected to cyclical droughts. Through these devices, therefore, a hitherto passive public space will become an active urban power plant fully integrated into the infrastructural network of the city.

Climatic intervention

Finally, the square aims to act as a device to improve the 'ergonomics' of democracy and public action (Lezaun, 2011) through different climatic interventions. This will be accomplished through the combined action of different devices. For example, a diagrammatic pavement has been carefully designed according to the varying solar incidence angles to work as an energy script to configure environments compatible with the current distribution of the flea-market stands and other recreational activities. In addition to this, a series of deciduous and evergreen trees will work with the hybrid urban trees to regulate temperatures through the use of pulverized water, strategic production of shade according to the varying paths and intensities of winter and summer suns, and through the production and channeling of wind drafts across the square (see Figure 4). This combination of technological trees and highly efficient natural deciduous species (Persian Lilac) will also work as a carbon dioxide drain system that will filter and recycle air in the square. The combination of different technical layers with the 'natural' species populating the square will generate livable and comfortable microenvironments for the existing social and economic activities taking place in the square (i.e. leisure or the flea market that takes place every Sunday) as well as promote the development of new ones.

From containers to interfaces

In contrast to traditional approaches to the design of public squares, in General Vara del Rey technological devices and natural elements have not been reduced to mere cosmetic, symbolic or decorative functions. Rather, they have been designed to work as active interfaces enacting a *specific* regime of cohabitation which connects and makes co-present in the space of the square seemingly disconnected social, natural and technological agents. As a result of this, solar radiation, rainwater, energy demands, economic transactions or recreational activities will be woven together in the square into a single sociotechnical continuum. It is important to underline here that Elii's proposed design is just *one* among a potentially indefinite number of possible designs. Other designs could have prioritized energy production over leisure, thus devoting more space

7 This calculation is based on Spanish legislation, which obliges energy companies to buy all the surplus electricity produced by photovoltaic infrastructures that is dumped to the network through a connection point. In the case of the square, this strategy will be used to cover the costs of the project by selling the energy generated by the photovoltaic panels. During the first phase of 10 years, the profit obtained from this will be used to cover the overrun costs derived from the photovoltaic infrastructure, which will be paid off in 10.5 years. From the 11th year onwards, the square will generate an average of €30,000 per year in profits.

to hybrid trees or to water hills. Or they could have taken the opposite route, prioritizing leisure over energy production, thus redistributing space in favor of recreational spaces. The selection of one design over another is, necessarily, a balance reached as a result of a political decision. Within the practice of design, each decision, like the position of the hybrid trees, the colors of the pavement, the position of the water hills or the selection and strategic display of evergreen and deciduous trees is inescapably a question of material politics; that is, a question of selecting between different ways of being and living together by generating a constellation of relations, hierarchies and patterns of reciprocity and participation among hitherto disparate entities.

Through the process of technification explored in this section, General Vara del Rey emerges as a hybridized urban ecosystem which disrupts the modern political ecology by making impossible any reading of the social, the natural or the technological *per se*. In so doing, the design of this square invites us to depart from the modern definition of public spaces as empty and passive 'containers' existing independently from other natural and infrastructural spaces, and to move in the direction of an understanding of public space as an *interface* that enables the creation of a novel system of participation and collaboration among disparate infrastructural, social and natural elements and processes.

Publicization of infrastructures: from matters of fact to matters of concern

In the previous section, we described the process of technification as a first step towards the reintegration of natural and technological elements into urban public space. The aim of this section is to complete this reintegration by transforming these new technological inhabitants into active participants in the public sphere. As we claim, this transformation can only be achieved if the technification of public spaces is accompanied by a symmetrical *publicization of infrastructures*. By publicization we do not simply mean to render infrastructures visible in public, but to transform them into genuine matters of public concern; that is, into subjects open to public scrutiny, discussion and accountability (Latour, 2004a). As we contend, to accomplish this transformation it is necessarily to rethink the relationship between citizens and infrastructures.

Most citizens living in developed urban environments relate to infrastructural processes as unproblematic 'matters of fact'. That is, for them, infrastructures like energy or water supplies exist ordinarily as taken-for-granted resources that can be easily called upon by the simple flip of a switch or by opening a tap. The complex networks of technologies, experts and political actors lying behind those mundane actions are rarely spared a thought. They exist as part of largely invisible 'subpolitical' worlds organized and managed by different forms of expert knowledge operating largely outside public debate and accountability (Marres and Lezaun, 2011). It is only when infrastructures fail, when the lights do not turn on or when water fails to emerge from the tap that these infrastructural worlds emerge as matters of public concern, as problems to be solved (Star, 1999; Klinenberg, 2003; Graham and Thrift, 2007; Giglioli and Swyngedouw, 2008; Graham, 2009). It is at these moments when infrastructures become visible and occupy the centre of public debate. However, the publicity of these infrastructural worlds is rarely, if ever, durable. When failures are fixed, these infrastructural worlds silently recede into the background of ordinary urban life to again become matters of fact outside the public sphere.⁸ This blackboxing of infrastructures as matters of fact not only

8 This is not the case in many of the rapidly developing urban centers of the global south where recurrent infrastructural failure turn infrastructures into perennial matters of public concern (Kooy and Bakker, 2008; McFarlane, 2008).

precludes the participation of citizens into the decisions involving the design of these infrastructures but also reduces them to undifferentiated and abstract 'users' (Graham and Marvin, 2001). The publicization of technologies that we describe in this section constitutes an attempt to prevent this process of blackboxing by sustaining the publicity of these infrastructural worlds as matters of public concern. The key question, of course, is how this condition of publicity can be accomplished and sustained over time.

One of the best strategies to publicize infrastructural processes as matters of public concern are some of the initiatives emerging over the last few years to 'unblackbox' domestic energy consumption patterns through the use of different monitoring tools, like smart energy meters, thermostats, light bulbs or boilers. By providing real-time readings of the carbon dioxide emitted to the atmosphere, kilowatts in use, or the monetary equivalence of energy consumption, these devices aim to raise awareness of the energetic and economic costs involved in mundane activities, like boiling a kettle or watching TV, and to induce, in so doing, ecologically conscious consumption behaviors.⁹ Different authors, however, have criticized these initiatives as a part of a growing trend towards the aestheticization and privatization of politics (Bauman, 1999; Clarke, 2007). For these critics, although the use of these technologies may well induce a change in individual behaviors, they do so by dangerously conflating political involvement to individual patterns of consumption, thus reducing political action to minimal and largely ineffectual scales of private action, with little real impact beyond comforting guilty consciences of the middle class or making some savings in the electricity bill. Contrary to this view, different authors have argued that far from operating a reduction or banalization of the political, these technologies can be seen as promising and effective 'technologies of citizenship' through which the private space of the home can be transformed into a site of political choices and action; that is, a place in which it is possible to engage with large political projects, like sustainable societies or low-carbon economy, through seemingly mundane everyday practices (Macnaghten, 2003; Lovell, 2004; Hobson, 2006; Marres, 2008; 2009; Jaque, 2011). From this perspective, private domestic spaces emerge as complementary political spaces in which political intervention takes place at the microscale of daily life and choices. In this sense, these authors argue that, by blurring the distinction between public and private spaces or between political actions and everyday practices, these technologies offer the opportunity to extend the sphere of the political beyond its traditional formats and sites.

General Vara del Rey constitutes an attempt to take the process of publicization operated by these domestic technologies one step further. Specifically, the square has been conceived as an experimental device to extend the process of publicization from the private space of the home to public urban spaces. Trapped within the spiraling growth of infrastructural and technological demands, most urban public spaces have been gradually divested of their political character as spaces of civic discussion, action and involvement. This is evident in the case of contemporary urban squares, which have been reduced to mere functional nodes articulating urban traffic, or to leisure spaces where busy citizens can momentarily evade the hustle and bustle of contemporary urban life. The project of General Vara del Rey aims to revert this trend by reformatting an urban public square into a site of political engagement. This will be accomplished through a radical publicization of infrastructures that will render some infrastructural processes visible and legible for citizens through a series of visually accessible spatial codes and indicators.

One of the main focuses of this project will be to publicize the process of energy production, a process that has been removed from urban public spaces and confined to power plants located in the peripheries of urban centers. This removal has resulted in the attenuation of the causal relation existing between individual and collective patterns of energy consumption and the large infrastructural resources and processes required to

9 For a domestic application of these devices, see Elii's work O57 – Insider (<http://www.elii.es/eng/index.php?/work/O57-insider/>).

sustain them. One of the results of this disconnection is the prevailing image of energy production as a seemingly effortless and unproblematic activity. For most citizens, electricity is considered and consumed as an endless resource always at hand to meet individual and collective needs. The square aims to counter this dominant view by visualizing the effort and time that goes into producing energy. This will be accomplished through a series of visual indicators allocated in the urban trees that will become more or less illuminated depending on the energy collected by the square during the day. In so doing, the square will convert the expert language of energy production into a readable code, thus transforming energy production into a publicly accessible issue. Moreover, by making visually accessible the variations of energy production throughout the day, the square will unsettle the public image of energy as a constant. Energy will emerge in the square as a variable resource that depends on a number of variable sociotechnical factors, like the changing intensities of sunlight or the efficiency of the technological infrastructures required to transform solar sun into usable energy.

A similar strategy has been designed to 'unblackbox' the processes of water collection and consumption. Both processes are critical issues in a city like Madrid, which suffers periodical droughts but in which water supply levels are ordinarily unknown to citizens. As in the case of energy consumption, the disconnection between small-scale individual actions and large-scale infrastructural processes has prevented the creation of a sustained individual commitment towards responsible patterns of water consumption in the city. The square aims to intervene in this political debate by thematizing water supplies as matters of public concern through two sets of devices. The first set of devices will be attached to the water tanks and will act as large public pluviometers indicating the amount of water collected by the square over each hydrologic year, thus making public the square's water resources. The aim of these devices is to call into question the predominant image of water as an inexhaustible resource by representing it as a finite and measurable public good. As the square consumes the collected water, the pluviometers will become a publicly accessible index of the amount of hydrological resources required to sustain the square, thus acting as a measure of the enormous amount of water required to feed even small-scale urban ecosystems.

The aim of the second set of water-related devices will be to publicize the often hidden large infrastructural networks upon which water distribution and consumption depends. This will be accomplished through a network of 13 ponds scattered around the square replicating the 13 water reservoirs from which Madrid collects its potable water. Each of the square ponds will be filled in the same proportion as the water reservoirs it mirrors, thus providing a real-time reading of Madrid's water supplies. Furthermore, by linking the local scale of the square and the larger regional scale of water reservoirs, the ponds will help to visualize the square as an element within a larger set of infrastructures, challenging the image of public squares as self-contained and discrete spaces within the urban fabric.

While energy indicators and pluviometers have been designed to thematize the large-scale territorial implications of water and energy production, another series of indicators will focus on visualizing the relationship between individual behaviors and collective ones. This will be done through a series of indicators focusing on publicizing recycling processes. In contrast to traditional recycling indicators, based on tightly defined protocols, instructions and prohibitions, the recycling indicators of the square will focus on translating individual recycling behaviors into readable energetic equivalences. Thus, rather than making the link between individual and collective actions through rules, these devices aim to establish this connection through the visualization of the effect that individual actions have in collective processes.

Finally, another series of indicators will concentrate on 'unblackboxing' the process of public investment in infrastructures. In contemporary Western democracies, citizens typically delegate the control of public investment in infrastructures to the state through taxes and, increasingly, to private companies subcontracted by the state (Torrance, 2008; Kirkpatrick and Smith, 2011). Public investment thus remains unaccountable and hidden

behind the state apparatus and different forms of expert and technical decision-making processes. The aim of the square will be to render public investment visible and accountable by informing citizens in real time about the extent to which the initial public investment required to build the square has been repaid. Over the duration of this process, which will expand over some decades, the urban trees will be changing their color as the initial investment is gradually repaid. In so doing, the square will render visible and accountable the process of public investment and will also help to understand the time and economic effort involved in investing in green technologies (see Figure 4).

Thematization and political participation

Thanks to the combined action of these indicators, the square aims to perform a double function. First, it will perform a civic function acting as a publicizing device through which citizens can learn about the often hidden sociotechnical ecosystem lying beneath the seemingly autonomous fabric of urban life. This process of visualization is not aimed at *solving* political problems, but at *thematizing* some infrastructural processes, like electrical and water consumption, recycling behaviors, or public investment, as matters of public concern. In other words, the square does not aim to provide political solutions to existing infrastructural problems (i.e. excessive energy or water consumption), but as a device to publicize these infrastructural problems as *political* problems open to public scrutiny and debate. Second, and as a consequence of the former, by enabling citizens to relate to these issues as matters of concern rather than as matters of fact, these indicators aim to transform the square into a possible site for political involvement. That is, they aim to transform the square into a polemical space by opening up different themes for political participation and discussion. However, this does not preclude other recreational or economic uses of the square. Citizens who wish to enter the square and use it as a space of leisure and recreation can do so, without needing to participate or engage in political discussions about public investment or water management. The square does not enforce participation in these debates. Quite the opposite, the square requires a civic effort on the side of the individual citizen as the prerequisite to participate in these debates. The spatial and color codes thematizing the different infrastructural processes are only readable from specific points of the square. Thus, the citizen willing to know how much energy the square has collected has to move to one of the specific points to make this political reading of the square. From any other point, the square emerges as standard recreational space. Additionally, the codes employed to convey infrastructural information have been deliberately designed not to be self-evident; they demand an effort to understand what they mean. For example, the citizen must learn that the different intensities of the light refer to the amount of energy collected on the day, or that the changing colors of the square over the years are an index of the process of repayment of the initial public investment. Thus, to reformat the square into a space of political involvement does not imply transforming it into a space of enforced citizenship and participation, but rather to transform it into a space in which political discussion and engagement is an option for those willing to participate.

Conclusion: the modest material politics of architectural design

General Vara del Rey has been designed as an experimental device to rethink the nature of public spaces in contemporary urban environments. Specifically, it is an attempt to call into question the dominant definition of urban public spaces as spaces segregated from other natural and infrastructural spaces. Through the double movement of *technifying public space* and the *publicization of infrastructures* the square aims to redefine an

existing public space by enabling the integration and participation of some of the infrastructural and natural elements that have remained veiled in the modern political ecology of the city. In so doing, General Vara del Rey aims to disrupt or suspend some of the dichotomies dominating modern urban environments like, for example, the opposition between public and infrastructural spaces, the confrontation between technology and society, the disconnection between individual behaviors and collective good, or the spatial and functional segregation of technology, nature and society. The disruption of these dichotomies can be seen as a first step towards a novel urban political ecology that recovers infrastructural and natural elements from the subpolitical worlds wherein they have been typically confined, and that incorporates them into the public and political life of the community.

Yet, as we have argued, the repoliticization of urban infrastructure and nature can only be achieved through a repoliticization of architectural design itself. General Vara del Rey constitutes a vivid reminder of the fact that when we design, we are not merely sorting or arranging different elements into a system of spatial positions, we are *also* generating and defining a very particular system of relations, hierarchies and patterns of reciprocity and participation between those elements. In short, we are defining ways of being and living together. It is for this reason that we would like to define architectural design as a form of ‘material politics’ (*cf.* Law and Mol, 2008), rather than as a simple material means for politics. To define architectural design as a form of material politics implies acknowledging that not every practice of architectural design enables the same ‘material politics’; that is, not every way of designing enables the same ways of dwelling and being together. Each architectural design lets us generate — and, crucially, *imagine* — different ways of being and dwelling together; that is, different ecologies of togetherness. The traditional and seemingly neutral tree-lined squares populating our cities are no less political than the proposed design for General Vara del Rey. Indeed, in spite of their apparent innocence as mere decorative elements, these ‘traditional’ squares spatialize a very particular grammar of relations and hierarchies that reinforces the separation between the human, natural and technological inhabitants of the city. The difference between General Vara del Rey and these squares, therefore, does not reside in the fact that General Vara del Rey has a political project while traditional squares do not, but rather in the kind of material politics they promote and enact. General Vara del Rey has been specifically designed to thematize *some* processes and relations as political — like water or energy consumption — but not others. In this sense, the project consciously implodes the distinction between aesthetics and politics as it understands that each design decision is always the inscription and materialization of a specific political ecology. In this sense, the critical questions we need to ask ourselves in the process of design are: what ways of living and being together are made possible and enacted by each specific design? And, more importantly, what designs do we need to pursue to construct a common world?

Both questions have become increasingly urgent in a world in which the modern ideal of cohabitation imagined by Haussmann and other reformers at the close of the nineteenth century has been short circuited by the unparalleled growth of infrastructural worlds and a spiraling ecological crisis that question the sustainability of inherited urban models and ways of living. In this context, there is a critical need to create urban political ecologies that reimagine the relationships between infrastructures, nature and society. General Vara del Rey aims to contribute to this process by opening up a new urban political space in which the relationship between these elements becomes a central matter of public concern and debate. Yet we should be very careful not to overstate the case. General Vara del Rey has been explicitly designed against those grand utopian modernist models that entrusted to urban and architectural design the task of social change. In contrast, General Vara del Rey emerges as a plea for *modest* design. By this we mean an architectural design practice whose aim is not to prescribe a script for specific political actions or programs (Jones *et al.*, 2011), but rather to generate spaces in which political discussion and civic engagement can take place, and where democratic

conflict and controversy can emerge (Mouffe, 2006). From this modest perspective, therefore, architectural design does not emerge as a form of political engineering but rather as a form of political rhetoric, a practice that attempts to seduce rather than to oblige, to propose rather than to prescribe, to persuade rather than to instruct, to nudge rather than to force (Thaler and Sunstein, 2008). In this sense, the political function of architectural design is not pedagogical; its aim is not to teach or inculcate certain values, codes or modes of behavior. Instead, its political function is to be polemical; its aim is to render visible and public a series of problems *qua* political problems. This is, precisely, the aim of General Vara del Rey: to *propose* a series of topics, such as energy consumption, as matters of public concern and to invite and persuade citizens to engage with them. The political importance of architectural design, it follows, does not reside in an illusionary power to change behaviors or consciousness, but in its power to propose new models of cohabitation and novel matters of concern, as well as to enable new spaces for political participation and engagement. Needless to say, how such engagement takes place is something that will be ultimately defined by the different ways in which its different users appropriate the square.

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