

The Politics of Cartographic Calculation and Coordination: State Mapping of Human Settlements in Lima

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Abstract

Focusing on mundane institutional practices in the production, use and circulation of cartography in Lima, in this article I provide a means to analyse planning governance in relation to settlements deemed 'informal/illegal'. I reveal the conflicting and competing rationalities within the state and demonstrate the multiple ways that politics of representation play out through omission, inclusion and partial visibility of low-income settlements, as well as through the production and reproduction of cartographic palimpsests. Adopting a socio-material perspective, and acknowledging the relationship between technical and political processes, I also expose the micro-politics at play and bring into view the negotiations that precipitate particular forms of planning.

Keywords

Mapping, cartography, planning governance, informal settlements, Lima,

Introduction

An uneasy relationship persists between state cartography and human settlements deemed 'informal/illegal'. Considering such settlements present a major challenge to contemporary planning and characterise the way many cities of the global South are growing (Watson, 2009), they are often excluded or misrepresented in official cartography (Kamalipour & Dovey, 2019; Lambert, 2015; Patel & Baptist, 2012). Acknowledging that cartography and planning are mutually constituted (Corner, 1999; Söderström, 1996), more attention is needed to critically examine how they relate to informal urbanisation. At the same time, technical processes and planning instruments (such as cartography) need further interrogation because they are predominantly considered secondary and marginal in comparison with other variables (Rydin, 2013; Sabatier, 2000). From a political sociology perspective, a small group of scholars engage with "issues of legitimacy, politicisation, or depoliticisation" (Lascoumes & Le Galès, 2004, p. 366) associated with different planning instruments and analyse the political effects and power relations instruments organize. These scholars argue that an examination of instrumentation can expose the mechanisms of power (Rydin & Tate, 2016) and should be considered at the same time as "the transformation of the state, the modes of domination and the government" (Lascoumes & Le Galès, 2004, p. 366). Contributing to this literature, I focus on the mapping of human settlements to better understand the workings of states, the micro-politics at play, and the effects on urban planning.

Cartography is increasingly being used in planning and policy-making circles to guide urban development visions and allocation of public investments. In relation to informal settlements,

researchers have noted the systematic ‘forgetting’ of human settlements in state maps (Kamalipour & Dovey 2019) and the damning consequences of being 'off the map' for marginalised inhabitants with regards to rights and access to resources. From a southern and post-colonial standpoint, scholars have offered a critical reading of state un/mapping to maintain hegemony (see for example Lambert & Allen, 2016; Patel & Baptist, 2012; Roy, 2009). As urban planning is taken as a form of deliberate social control and oppression, exercised by elites over weaker groups (Yiftachel 2009; Porter 2011; De Satge & Watson 2018), cartography in turn supports the ‘dark’ side of planning (Yiftachel, 1998) since state power is grounded in the formulation and circulation of geographic knowledge (Crampton & Elden, 2006). To counteract marginalisation and domination, initiatives of community-based mapping are often directed at reframing state misrepresentations and enhancing visibility (see for example Peluso 1995; Pervaiz et al. 2008; Lambert 2015; Roth 2009). Existing accounts, that engage with mapping from a global South perspective, provide a limited analysis of the cartographic practices of different state institutions and how these relate to one another and to the planning system more generally. These accounts predominantly treat the state as coherent and 'powerful', engaged in processes and planning instruments that are aligned with governmental objectives and outcomes.

In this article, I focus on the cartographic representation of human settlements in Lima, Peru, and seek to contribute to the existing literature on three main fronts. First, recognising the heterogeneity of the state, I pay attention to the different governmental organisations and their rationalities, how these interact, and how they relate to the overarching and normative planning objectives foregrounded in policies and official discourse. Second, counteracting the disproportionate focus on political processes in existing planning literature, I draw from Science and Technology Studies and examine the politics of technical processes. I undertake a double interrogation - how cartography is used in line with specific objectives, as well as

the structuring effects of cartography. Third, I move away from the grand narratives that dominate existing mapping accounts to critically engage with mundane cartographic practices of various state institutions, to expose the micro-politics within cartographic production, use and circulation, and the contingent factors that influence planning processes.

Taking a socio-material and relational perspective, I address the following question through extensive case study research: what are the rationalities and cartographic practices of different government institutions concerning human settlements in Lima, and how do these influence planning and outcomes?

The research was conducted over a five-year period from 2013-2018 in an area at the border of two districts in Lima, Peru: San Juan de Lurigancho in Lima province - one of the most populous districts of Lima with over one million inhabitants - and San Antonio - a rural district in Huarochiri province. Located at the periphery of the city, the area is experiencing rapid urbanisation of steep desert slopes and the establishment of settlements deemed informal/illegal. This area exemplifies the way Lima is growing and the conditions under which 30% of its population, or 2.8 million inhabitants, currently live (Laos, 2016).

In this article, I offer a brief review of literature that addresses state mapping in the context of informal settlements, noting the gaps which need further probing. I subsequently explain the context outlining the various institutions that play a role at different stages in the formation and consolidation of settlements at the periphery of Lima. I examine the cartographic calculation and coordination that take place within these different institutions, and I conclude by highlighting three main points. As multiple representations of human settlements co-exist, with instances of cartographic exclusion, inclusion with limited visibility, and partial representation, a more nuanced approach is needed beyond the mapping/unmapping dichotomies often emphasised in scholarship. Moreover, rationalities and planning

instruments do not always align and can produce effects that work against objectives, thus calling for more research on how rationalities, practices and outcomes relate, and the structuring role of planning instruments. Finally, the conflicting and competing rationalities within the state are brought into view. These materialise in cartographic palimpsests that open spaces for new regimes of urban governance that undermine the state's capacity to control and govern territory. This article makes an empirical and methodological contribution to planning studies by demonstrating the effect of cartographic production and circulation on planning in the context of informal urbanisation, as well as showing an effective way of researching the state and urban planning governance.

Cartography as a Tool of Power

Maps encapsulate planning objectives and help coordinate and guide action on the ground. At the same time, maps influence the framing of problems and the way solutions are conceived. As a social construction, cartography is not neutral but deeply political and therefore problematic with regard to representation, positionality, and the partiality of knowledge it embodies (Crampton, 2001; Harley, 1988; Pickles, 1991). Like any language, it is not merely contemplative or justificatory but performative (Dodge et al., 2011).

Scholars have approached cartography in various ways. Of particular weight, due to the number of academic contributions, cartography is foregrounded as a technology of government (McCormack, 2012) to maintain state rule (Edney, 2011). Maps play a crucial role in the construction of states and identities (Radcliffe, 2009; Wood, 2010). They have been critically theorised for producing and maintaining colonialism, property ownership, race, military power, bureaucracy and gender norms (see for example Anderson, 2009; Haraway, 1992; Pickles, 2004).

In his book *Seeing like the State*, Scott (1998) argues that mapping is a strategy of territory and 'making legible' for purposes of intervention. He notes how government inherently involves the mobilisation of ways of 'seeing' that shape the perceived terrain according to the perspectives of government. Following Foucault, Miller and Rose (1990) argue that the link between political rationalities and technologies makes programmes of governing possible. Thus, "all government depends on a particular mode of 'representation': the elaboration of a language for depicting the domain in question that claims both to grasp the nature of that reality represented, and literally to represent it in a form amenable to political deliberation, argument and scheming" (Miller & Rose, 1990, p. 6). By rendering thought into a technical form, authorities can act on conduct 'at a distance'. Mapping makes the subject under observation graspable in quantifiable terms and potentialises action.

Scholars that engage critically with state mapping of informal settlements also take this line of interrogation. They frame mapping as a strategy of the elite to control and dominate the urban poor and their spaces. Even in the seemingly 'technical' processes of land titling, the apparatus of the state is understood to operate actively to amass power. Land titling relies on graphic representation and geo-coding. The general organisation of space according to the logic of numbers assists the production of calculable space, tying individuals to property regimes (Blomley, 2003; Crampton, 2007; Foucault, 2007). For human settlements, mapping as a strategy to 'formalise the informal' is a means of curbing the previously 'unruly' into a determined order and enhance the capacity of the state to govern the population (Crampton, 2010; Rose-Redwood, 2012), as well as generate revenue by incorporating 'the informals' into a formal tax system. Similarly, the marginalising effects of state mapping have been explored in the context of eviction and redevelopment. The misrepresentation of territories as areas that concentrate social and physical risks paves the way for discriminatory actions of governmental institutions, at the same time as legitimising them (Lambert & Allen, 2016a).

In a similar way to state mapping, unmapping (or the absence of mapping) has been framed as a power-wielding strategy rather than the sole consequence of resource deficiencies or technical incapacities. In the context of Calcutta in India, Roy (2009) contends that purposeful unmapping of peri-urban areas is a means for the state to maintain 'calculated flexibility' and enable it to "alter land use, deploy eminent domain, and to acquire land" (Roy, 2009, p. 81). Thus unmapping, she notes, is a form of governing that relies on the apparent disorder of urban informality to render land claims constantly negotiable with political actors within the state. The exclusion of human settlements from official maps is noticeable in many cities of the global South; even in those instances where 'informal/illegal' settlements house most of the urban population and play a vital role in the economy, such as Dharavi, Mumbai; Kibera, Nairobi, and Old Fadama, Accra. The deliberate stance to keep settlements 'off the map' is seen as a means to withhold entitlements reserved for 'recognised' citizens (Glöckner et al., 2004; Karanja, 2010). For many excluded groups, therefore, being inserted in official maps forms part of the political struggle for recognition and a tactic to enhance negotiation for just processes and equitable resource distribution (Harris & Hazen, 2006; Pervaiz et al., 2008).

These rich accounts of state un/mapping in global South contexts advance the conceptualisation of cartography as part of discursive political processes and ways of seeing and acting that reproduce injustices. However, there is still room to advance the approach to states, technologies and their relation to planning. The state is often re-edified as a largely homogeneous entity that acts in a strategic and authoritative manner with equally coherent interests. As practice and institutional turns in planning theory have demonstrated, states do not have the unity ascribed to them, and planning is constituted through complex political struggles (Silva et al., 2015) with inherent disjunctures between different levels of

government as they battle for power (Sundaresan, 2013). States are porous and operate through heterogeneous practices. They include different departments and government units at different scales with conflicting political interests, as well as actors in various positions and levels of influence, from high ranking politicians to department chiefs, public officials, planners, and street level bureaucrats (Corbridge et al., 2005; Das & Poole, 2004). In such a diverse landscape, a disaggregated interrogation is needed to understand the different rationalities that characterise states, how these relate to cartography as an instrument of planning and a technology of government. The assumption of a linear connection between meditated objectives and planning outcomes also needs to be problematised. Furthermore, these mapping accounts lack critical engagement with the mundane processes of cartographic production and predominantly consider maps as stable components of discursive formations.

Geography and critical cartography go a long way to interrogate the agency of maps and their structuring effects. As inscriptions (Pickles, 2004) or a system of propositions (Wood & Fels, 2008), maps are open to interpretation and work in unexpected ways, escaping the design of the user and producing unintended consequences (Fox et al. 2005; Roth 2009; Radcliffe 2010). From a non-representational perspective and Science and Technology Studies, scholars highlight maps as actors that can change the course of action (see Del Casino & Hanna, 2006; Kitchin et al., 2013). Maps form part of an assemblage of people, discursive processes and material things working in concert with others, to transform the world (Latour, 2005).

Using Latour's language, there are two ways of understanding maps: as intermediaries or mediators. An intermediary is that which transports meaning or force without transformation. On the other hand, a mediator transforms, translates, distorts, and modifies the meaning or the elements it is supposed to carry (Latour, 1996). Although a fundamental difference exists, it is worth maintaining both conceptualisations in any analysis because of the different entry

points they present for research. As intermediaries, maps reveal something of the actors that deploy them. Aspirations are underpinned by particular rationalities that determine means and ends in the hope of producing desired effects and averting unwanted results (Miller & Rose, 1990, p. 7). Focusing on the means, in this case cartography, provides a window into those who adopt it, and a way of getting closer to their aspirations, beliefs, and values.

On the other hand, taking maps as mediators emphasises the way they change the course of action and are part of calculations. The term 'calculation' refers to the production of possibilities from multiple relationships in the hope of furthering objectives. I pay attention to the different factors that come to structure a calculation and observe negotiations between actors (human and material). Examining intermediary as much as mediatory roles, I analyse the practices of calculation and coordination involved in the production, use and circulation of cartography.

Unpacking Cartographic Practices

To first understand the different processes in the formation and consolidation of human settlements, I conducted in-depth interviews with settlement leaders and identified the procedures and pre-requisites needed for recognition, acquisition of basic services, and land titling. At the same time, borrowing from Institutional Ethnography (IE), I traced how spatial information travelled. IE, developed by Dorothy Smith in the early 80s, is an approach used to investigate the social, focusing on textually-mediated social organisation. IE refers to the investigation of empirical linkages among local settings of everyday life, organisations, and trans-local processes of administration and governance. It relies on mapping as it follows the circulation of texts, bringing into view the different interconnected sites. Texts refer to documents or any type of representation that has a “relatively fixed and replicable character” (Devault & McCoy, 2002, p. 765). IE examines what happens in these sites with the text; it

analyses how a text enters into, shapes and “coordinates people's doings across time and space” (Smith & Turner, 2014, p. 5).

Using flow diagrams, I captured how maps travelled, revealing the different governmental and non-governmental actors that come to play a role. Adopting a snowballing interview strategy, I accessed various heads of departments, who in turn gave me access to technicians in their division. The institutions included departments within the district municipalities of San Juan de Lurigancho and San Antonio, the Metropolitan Municipality of Lima, the Ministries (Housing, Transport, Economy and Finance), the Commission for the Formalisation of Informal Property (COFOPRI), the Public Registry, the Institute of Metropolitan Planning, the military institutions (SEA and IGN) that produce the maps for the entire city, as well as water and electricity providers (SEDAPAL and EDELNOR). These amounted to 17 governmental institutions (national and local). In many instances, I interviewed the same person more than once over the course of the five-year research, with repeated interactions building familiarity and trust. In total, I conducted 45 interviews with officials, 6 with service providers, 12 with academics, 10 with NGOs, 13 with independent engineers working with human settlement. I also studied 20 settlements and spoke to several community leaders and inhabitants (men and women). These amounted to a conservative estimate of 160 people in the total period of six months and three weeks in the field. In sum, I conducted 246 in-depth open and semi-structured interviews.

To understand cartographic calculation, I sought to discern the discourses and practices that accompanied the cartographic production stage, while considering the various economic, technical, social and political factors influencing the process. I shadowed informants at work. This involved following technicians over a couple of hours during their routinised tasks. I combined shadowing and participant observation with in-depth interviews so people could explain what they were doing and why. Through ethnographic methods, I formed a detailed

understanding of the different actors, spatial information and instruments mobilised in map-making, as well as the negotiations and trade-offs involved in shaping representation.

Lima's Human settlements and Planning

At the epicentre of the national industry and economy, Lima has undergone rapid urbanisation, reaching 9.7 million inhabitants (INEI, 2020). This growth has come with challenges for urban planning and the distribution of resources, and is underpinned by the inability of city authorities to keep up with the required housing and basic services provision. Lima's growth is characterised by low income human settlements or *barriadas* that develop through auto-construction. Over the last three decades, in the absence of adequate urban land, settlements have increasingly occupied steep slopes in the periphery, extending the urban footprint beyond the boundary of the city in areas deemed high-risk by city authorities (Figure 1).

Figure 1: Human settlements in the periphery of Lima extend into the desert beyond the metropolitan boundary. Photos © author (2016)



Since their emergence in the 1940s, *barriadas* and the planning system in Lima have mutually influenced one another. The State planning apparatus has been involved to various degrees and responded through the application of existing norms and institutions. The different phases from repression, tolerance, concession of rights, and finally, recognition have themselves developed the institutional frame (de Soto, 1989; Eyzaguirre, 1998; Mosqueira, 2000).

Multiple official framings of Lima's human settlements have co-existed for decades and have guided the state's cartographic production. On the one hand, official discourses present human settlements as violations of property rights and zoning laws; on the other, they frame these as patriotic bids for human rights and social justice since land is a common good and housing is a basic entitlement for all citizens. Notably, each of the three levels of government

- district, metropolitan, and national – take a different approach to human settlements. Authorities at the district level assume a relatively permissive stance, even toward settlements in areas deemed high-risk by the national government.

Following the decentralisation process in 1981, the organisation, planning, and control of urban development was devolved to the 43 district municipalities that make up the metropolitan area and Lima Province. Each district municipality is responsible for the settlements within its jurisdiction. However, different governmental entities come into play to enable inhabitants to climb a ladder of entitlements. Having different objectives and remits, their discourses concerning human settlements vary and so does their cartography.

The different development stages of settlements go hand in hand with several governmental processes. These include recognition and certification, allowing inhabitants to acquire water from the national water authority under the Ministry of Housing, and electricity from the private electricity provider. Moreover, if settlements have been established before 31st December 2004, they are eligible for land titling through COFOPRI, the Commission for the Formalisation of Informal Property under the Ministry of Housing. Recognition and certification are under the remit of district municipalities, and involve the departments of Cadastre and Urban Development, as well as the Department of Civil Defence in charge of risk evaluation before settlements can apply for services. The higher levels of government, namely the Metropolitan Municipality of Lima and its own National Institute for Civil Defence (INDECI), become involved in the final stages before land titles are issued by COFOPRI.

Cartographic Calculation and Coordination in Lima

As verbalised by many authorities interviewed, the normative objective of the state is to plan the territory in an integrated manner. The need for cartography is widely acknowledged, *as highlighted* by a senior official: "the best instrument for development is cartography. Without knowing where the population is located, one cannot plan and resources cannot effectively be distributed making it difficult to combat poverty at the national level" (interview with official from Ministry of Transport, October 2015). Despite the recognition of cartography as an important device for government work, areas which are urbanising through processes considered informal or illegal are left blank on metropolitan maps. Only those settlements which have received land titles through COFOPRI are represented at this level.

Settlements on the peripheral slopes present various conditions. These include those newly established with limited infrastructure; those more advanced in their development and entitled to services; and those that have sufficiently progressed and are eligible for titling but are still waiting for the lengthy formalisation process to conclude (interview with engineer from Civil Defence, October 2016). All these different conditions taken together mean that a large part of the city's metropolitan area is excluded in city maps (interview with head of COFOPRI, May 2017). Even if settlements at the periphery are recognised at the local level, having gone through stipulated municipal processes, discourses of illegality and informality support the withholding of public investments, as stated by the head of Civil Defence at metropolitan level:

"The settlements higher up the slope are informal so they cannot be included in the metropolitan maps even if they have been recognised and certified by the

district municipality. They are illegal. If we don't take a stance, people will keep invading and there will be no end to it” (interview, May 2016).

The deliberate omission of selected urban areas has a paradoxical impact on the ability of institutions at this higher level of government to plan, and may even produce undesired results. This is evident when analysing the risk mitigation programmes and risk mapping undertaken by the national government. One of the few institutional programmes launched by the Metropolitan Municipality of Lima in 2012, specifically devised for areas deemed high-risk on the peripheral slopes, was Barrio Mio, meaning 'my neighbourhood'. The aim of the programme was “to improve the quality of life in working class neighbourhoods and settlements around the city, through the efforts of local and state government with active community participation” (La Republica, 2013). About 400 million Peruvian Soles (approximately USD 122 million) of public investment were earmarked to bring infrastructure and services to the poorest areas in the city, including 700 outdoor staircases and 1000 retention walls to mitigate the precarious conditions on the slopes (Municipalidad Metropolitana de Lima, 2012). Communities taking part in the programme, eligible only if they belonged to titled settlements, were expected to engage in participatory mapping to identify areas of risk and thus inform the location of retention walls and staircases.

The maps used as a basis for discussion and proposals only show titled areas, leaving all untitled areas blank as though they were uninhabited. When asked why, the former head of the programme explained that during the participatory process with inhabitants, it is important to focus on the areas that can receive intervention:

"If we include all the settlements on the slopes, with and without titles, it might cause misunderstandings as to who is included or excluded. Also, we can't afford for the discussion to go somewhere where our remit does not permit. Of course,

there is a flaw: risk is everywhere on the slope, but we can only tackle a fraction of the slope" (interview with former head of Barrio Mio, May 2016).

The maps delimit the scope of the programme and determine the conditions for inhabitants' participation. At the same time, they contribute to a fragmented vision of the territory, undermining the goals of the risk mitigation sought. Without an overall strategy to halt the occupation of areas further upslope, risk is continuously reproduced. The new settlers' autonomous efforts to mitigate risk on the higher areas, through the opening of roads and the construction of retention walls, among other practices, leads to instability of the entire slope, with many residents experiencing rock falls. The lack of a comprehensive vision exacerbates risk for all inhabitants, regardless of where they are located (Lambert & Allen, 2016a).

The rationality that seeks to control invasions by excluding settlements considered informal/illegal structures the risk mitigation programme from the start. Such a rationality clashes with that of risk management, generating an unresolved contradiction: neither invasions nor risk are contained; on the contrary, by tackling areas in isolation, both are promoted.

One would expect the more utilitarian maps used for the work of government to capture all settlements, whether 'formal' or 'informal', especially those produced by the National Institute for Civil Defence (INDECI) at the metropolitan level - in charge of risk prevention and response at the metropolitan level. The aim of cartography is to guide prospective and reactive planning, which requires a means to grasp the spatial distribution of the entire population (interview with risk estimator from the district municipality of San Juan de Lurigancho, November 2016). However, INDECI's maps omit settlements which have not received land titles. The administration thus fails to grasp the full extent of land occupation and urbanisation, *undermining the possibility of planning to manage risk*.

In addition to the political rationality that upholds the exclusion of human settlements, the findings demonstrate that cartographic omission is structured by the instruments and conventions used. This is evident, for example, when analysing the processes of the National Aero Photography Service which oversees the production of aerial photography in Peru. Technicians produce drawings from aerial images (Figure 2) captured through intermittent flights. Open source applications such as Google Maps/Earth are not used because, as many authorities explained, they are not official Peruvian government sources. In this process of translating the images, areas that clearly show the emergence of human settlements are left blank, as one of the technicians explains:

"At this early stage, I should draw everything that is on the aerial. I can see dirt roads but no asphalted streets or visibly delimited plots. How can I show these shacks? I am restricted by the cartographic conventions of streets and plots. So, I leave areas in-the-making out of my drawing and effectively show no habitation" (interview, October 2015).

Figure 2: Workstation where aerial images are translated into line drawings. Photo © author (2015)



Technology and its parameters are active in determining what can be represented as well as shape the action space of social actors. Instruments, standards, and procedures involved in map production operate as mediators, structuring calculations and propagating further exclusions. The standardised codes and rules that govern cartographic conventions are based on abstraction, selecting particular elements over others, lending hierarchy and order, but in so doing, leave out aspects which cannot be subjected to these conventions. Moreover, the instruments used to capture, draw and represent settlements delineate boundaries around that which can be represented, thereby foreclosing other possibilities. Settlements on the slopes generally progress in a slow, uneven manner. Even if inhabited for many years, they will only be captured on maps once they have reached an advanced stage of development because of the mapping process (interview with technician from National Aero Photography Service, October 2015).

Although, at these higher levels, there is an interplay between the meditated omissions and those produced by the instruments and processes used, SEDAPAL, the water authority under

the Ministry of Housing, presents a different approach. Whether titled or untitled, SEDAPAL captures all settlements to the level of detail which includes individual plots and roads. As noted by technicians, the institution produces cartography using the latest technology and has the most up-to-date information on the city. The head of the technical department in SEDAPAL describes the economic rationality driving the work:

"We manage our current and future clients, no matter their status. In many cases we rely on the settlements' own plans and add their plans to our database. Until the plans are approved and certified by the district municipality, we cannot provide water, but we nevertheless know where plots are and how many people are waiting for water. In this way we are able to plan better and know where to invest" (interview, October 2016).

Although constructed as a patchwork of spatial information which includes data informally acquired from settlements, SEDAPAL's cartographic base is the most advanced in the country and would make an ideal foundation for coordinating planning efforts between all institutions (interview with official from Ministry of Housing, April 2017). However, its maps do not circulate between institutions, as an informant notes: "SEDAPAL operates as a private entity rather than part of other government institutions since Fujimori prepared it for privatisation in the 90s. It has invested many resources, time and money to produce this information and they want to protect it" (interview with official from the Ministry of Housing, October 2017). Despite SEDAPAL and COFOPRI both belonging to the Ministry of Housing, each have established boundaries concerning sharing spatial information. They take a competitive stance rather than one of cooperation. The case is no different between other institutions. Large-scale disasters, such as earthquakes or weather-induced events that lead to floods and landslides, may be the only instances disrupting business as usual. In such

cases, an emergency decree activates the emergency commissions within each ministry, and all entities involved in disaster response share their available cartography.

At the district municipal level, there is yet another reality regarding the discourse and representations of human settlements. Officials and technicians maintain a certain closeness with inhabitants, facilitating their progress from recognition to certification for basic services. As many settlement leaders have reported, the administration gains political support in the form of votes in exchange for donating cement, expediting the bureaucratic process, or otherwise assisting settlements in their development. Thus a mutually beneficial relationship exists. Moreover, the political discourse displays compassion toward inhabitants, as evidenced below:

“What can we do? these people are poor; they need a place to live. And us, as the government, we do not give them any other alternative. So, we can only support them and allow them to access water and electricity. How can anyone live without? The law is for the people, those who are in real need" (interview with head of the district municipality of SJL, May 2016).

The economic and political gains are entangled with humanitarian and developmental aspirations. The district municipality recognises all settlements on government land regardless of when they were established. The process requires all new settlements to produce their own settlement layout plan, which they submit for recognition and certification to acquire basic services. Once a settlement's request is approved, its perimeter is drawn on the AutoCAD base file held within the district municipal offices. There is partial visibility of settlements at this level since only the perimeter is shown. The law stipulates that only roads can be certified; nevertheless, these never make it onto the official cartographic base. When asked to explain, the head of the Cadastre Office declared that "it is a technical issue with the

computer. The file is too heavy. If we add all the plots and the roads it would take forever to load, and we couldn't do our work, so we just draw the perimeter" (interview with municipality of SJL, May 2015). Here, the computer's capacity is somewhat responsible for upholding the hierarchical position of the perimeter which, discursively at least, should not be considered in any case.

The partial visibility achieved through these municipal processes is not extended beyond the district level, even though coordination between different levels of government is required by law. For example, the Civil Defence Department at the district municipality level produces risk maps of its jurisdiction that should be integrated into the database of the Civil Defence Department at the metropolitan level; in practice, however, there is a complete disconnect between these two entities. According to the risk estimator within the district municipality of SJL, ongoing tension between the two offices hinders information sharing, as he explains:

" They [Civil Defence at the metropolitan level] say there is no quality control in these areas. Settlers build as they like in a risk zone which is not meant to be occupied. In this way, they wash their hands of any obligations towards the people and altogether ignore them. But the issue is that we, in this department, need to know where these settlements are located so we can plan our risk mitigation and prevention. Since we have carved a path for regularisation of settlements in these high-risk zones, we are responsible for their security and that of the entire district. We must think and work with prevention in mind and I need the spatial information to plan for a disaster, stock up my warehouses with humanitarian aid supplies" (interview, Nov 2016).

The risk estimator takes it upon himself to produce the information. On his computer, he draws the approximate location of settlements in AutoCAD, using the COFOPRI map as a

base which only includes titled settlements. He hatches the estimated area of each settlement, including the names of those he has come across while walking in the hills. The rough representations strongly contrast with the detailed drawings of formalised settlements, which are captured down to the level of each individual plot, as seen in Figure 3. The titled areas classified as high-risk are coloured in red, while the hatched areas, facing even more dangerous conditions, are barely perceptible.

Figure 3: Photograph of the map produced by the risk estimator within the Civil Defence Department of the district municipality. Photo © author (2016)



This valuable information, even if incomplete, does not travel to other departments at the district or national level, nor to different departments within the same district municipality. Locally stored within the risk estimator's computer, it has limited reach to inform planning and the information can easily be erased or corrupted.

The findings above demonstrate the different rationalities. Various cartographic conditions co-exist, from complete exclusion, to partial inclusion at the district level, to detailed capture but with a limited audience in the case of the water authority's cartography. Each institution works in isolation, producing its own cartography to serve its own objectives, which can contradict those of others and, at the same time, impact the possibility of integrated planning. Moreover, the production and reproduction of cartographic palimpsests come to influence regimes of urban governance.

Clashing Rationalities and Cartographic Palimpsests

Myriad interacting factors contribute to the palimpsest. Besides the different cartographic practices, the uneven application of technological advances and the co-existence of maps, some inherited from the past, result in an irreconcilable patchwork of cartographic information which, in turn, hinders coordination. As explained by interviewees the cartography, riddled with discrepancies and errors, propagates a fragmented logic and an atomised work ethic.

The palimpsest that is apparent at the national scale plays out in specific ways in the case study area. As explained, district municipalities construct their maps using perimeter outlines of settlements within their jurisdiction. However, since municipalities maintain their own cartography in isolation, conflicting land claims can lead to tensions between adjoining districts. This is the case with the neighbouring districts of San Juan de Lurigancho in Lima and San Antonio in Huarochiri province, which have not yet resolved an ongoing border dispute. As noted by a technician within the San Juan de Lurigancho urban planning department:

"The cartography that we hold here is different from the one in San Antonio so there is a grey area. This is taken advantage of by unscrupulous land speculators as no single cartographic base can be used to control and govern the territory" (interview, May 2017).

The findings reveal how palimpsests are as much the result of deliberate actions as they are of inefficiencies, lack of coordination and technical limitations. Over the five years of research, I noted how some institutions purposefully tamper with spatial information to make governing difficult. Intentional cartographic erasure is a common phenomenon used by outgoing administrations to create stumbling blocks for those taking over after an election. The information is at the mercy of various cycles of incoming administrations. Presidential elections and mayoral elections are inter-phased, each taking place every four years. The frequency of elections often leads to high turnover of officials in positions of authority, as well as limited continuity of projects and programmes if these do not align with the objectives of an incoming administration.

In December 2014, I interviewed various technicians and heads of department working under Mayoress Susana Villarán in the Municipality of SJL. Several months later in January 2015, after Luis Castañeda had assumed the Mayoralty, I interviewed the same individuals after they had left their positions. With every change in administration, they reported, spatial information was lost or manipulated. In November 2014, I received an AutoCAD file from the head of the Urban Development Office in SJL containing the district's settlement perimeters. In February 2015, I received a second file from the same department. The difference between the two was remarkable. Many previously recognised settlements were now absent from the digital record. The head of the Cadastre Department explained the incongruence between the two AutoCAD versions:

"Much of the information produced within the ruling period of the previous government has been lost. They have erased everything. It is easy to erase files or take them away from the office because everyone works locally on their computer and keeps the files on their hard drive. If we now have maps of the district, it is because we have rebuilt them. We have searched for the information to reconstruct them... some people have brought it in pieces, nevertheless it is still incomplete. We have a long way to go" (interview, February 2015).

Many informants have reported that erasure and tampering of spatial information is a common and pervasive practice of district municipalities, as it does not travel to other databases, despite the requirement in law. The information of settlements not yet formalised is particularly susceptible to tampering and loss especially since the process from recognition to formalisation can take many years to complete. By contrast, formalised settlements are sedimented in COFOPRI's database and have thus acquired an intangible, permanent status. The institutional memory of the district is also affected to the point of requiring a substantial effort to reconstruct it. As the head of the Cadastre Department laments, planning cannot be a priority, with work processes mainly focused on rebuilding the past and present:

"I should be dedicating my time to the cadastre and planning for the time ahead. Yet look at my desk full of files. I need to go through them all. Most of them are from settlements that have already been recognised but have an irregularity because they are incompatible with the information we currently hold in our computers" (interview, February 2015).

This situation comes with consequences for inhabitants. One community leader recounts how he has visited the municipality every week for months after receiving a notification refusing

to accept the boundary of his settlement, which was seen to clash with that of an adjacent settlement. For the records to be updated, he needs to prove that the copy of the certified plan he holds was issued by the district municipality and is indeed genuine. The head of Cadastre corroborates that such cases are commonplace:

"We don't have their information anymore, so we ask them to bring their plan back to us. In effect, it has been approved by us as 'the municipality', but it does not appear in our database. We have endless cases like this. In reality they [the previous government] have done much damage. Although they were targeting us in this new administration, the damage is mostly to the people because they are the ones who suffer delays caused by the process of rectification, and they have to make the extra effort to come back here and follow their case" (interview, February 2015).

Loss of spatial information creates confusion and incapacitates the new administration. Planning becomes a challenge, as the district municipality cannot grasp the full extent of its territory. In this way, governing the ever-growing number of settlements in the city's periphery is embroiled in a continuous process of muddling through, sorting information, noting gaps, and reconstructing erasures. The investment incurred to rectify/redraw/reassemble information is as much a burden for the administration as it is for inhabitants. Usually, time runs out before the files are updated, and with every new administration comes new erasures. The spatial information can only ever be an incomplete patchwork of records. Even with the city's best intentions, settlements may not seek to rectify their records if they are not undergoing a process requiring them to deal with the municipality. Unless they do, inconsistencies are sure to be everlasting.

In their interviews, numerous officials accepted their constraints concerning urban planning. However, as many highlight, areas where the cartography is not yet fixed can be contested and this sustains the activities of land speculators who take advantage of the disorder to have their own paperwork certified, claiming land that belongs to others. The cartographic palimpsest supports a unique governance system that promotes the continuous occupation of high-risk areas further into the desert. The unmapping or under-mapping by government institutions enables the mapping of others and thus needs to be understood relationally. In the case of the peripheral slopes of Lima, the conflicting and competing rationalities that characterise the state hinder the possibility for integrated planning and support the production of cartographic inconsistencies that enable land speculators to continuously claim through their own mapping efforts.

Conclusion

The in-depth analysis of institutional cartographic practices, at the national, metropolitan, and district level has demonstrated the multiple ways that politics of representation play out through omission, inclusion and partial visibility of human settlements, as well as the production and reproduction of cartographic palimpsests. Going beyond the mapping/unmapping dichotomies maintained in existing scholarship, this article shows the need for a nuanced approach that engages critically with the production, use and circulation of cartography in planning. Focusing on cartographic practices has provided a means to observe the interactions between agency and structure. Moreover, taking a socio-material approach, and examining the seemingly mundane world of technical processes and materially mediated practices has revealed micro-politics, exposing the negotiations that precipitate particular forms of planning.

Furthermore, the interrogation through cartography has provided a means to analyse the state, and offered a significant avenue for reflection to understand contemporary planning governance. The findings revealed the paradoxes and conflicts that emerge from the complex interactions amongst different rationalities and how these impact the urbanisation of the slopes in Lima. The purposeful omission of 'informal' settlements from official city maps functions as intended: to withhold legitimacy and entitlements. At the same time, it limits the state's ability to manage its territory. Similarly, the rationality to control invasions and manage risk leads to outcomes that sustain the urbanisation of high-risk areas. Additionally, the chaotic cartographic landscape that leads to a fragmented planning logic is not always accidental or an externality of technical processes, but can be a meditated outcome of the state's competitive rationality.

I have revealed in this article how governmental rationalities and planning instruments are not always aligned. Officials and technicians seek to govern through cartography, but at the same time, they have to govern cartography. The standards and instruments they abide by paradoxically play a part in creating and maintaining a cartographic landscape riddled with inconsistencies, errors, and absences. The internalisation of these undesired outcomes leads to further administrative disorder, and muddling through becomes the everyday work of government. The resultant cartographic palimpsest provides fertile ground for land speculators, giving way to an urban governance regime that works against the normative objectives of the state. Thus, future research could better understand how mapping plays out relationally.

The research makes a methodological contribution to planning studies. Focusing on cartography, it offers a means of researching the links between regulatory frameworks, practices and outcomes, overcoming the theoretical divide that is often maintained between substantive and procedural aspects of planning. It also provides a way to study transversal

social processes and raises awareness of the interconnected and co-constituted relationship between politics and technologies. Too often, technical processes and technicians receive little attention in planning theory for being conceived as somewhat a-political. Yet, losing sight of the technical, and its relationship with the political, risks overlooking important dynamics as the political is technical and the technical is political.

Although I here interrogate a given context, the approach through cartographic practices can be applied more widely to examine urban processes and planning in different contexts and at different scales. Because of cartography's universal use in planning projects and processes, as well as its ability to operate 'at a distance', it offers a practical way to unravel complex networks across space, convening the range of actors shaping planning processes and outcomes. Conceptually, as planning is embedded in governance networks, it is context specific and can therefore take different forms. The approach through cartography can thus reveal different types of planning that coexist in the city. Moreover, paying attention to flows of spatial information to observe inter-relations can help rethink the city and the spatial distinctions often maintained between different areas.

Similarly, at a broader scale of analysis, one could use this methodology to understand the circulation of spatial knowledge and the networks that constitute the growing transnational market of planning ideas and projects. The approach through cartography and ethnographic methods has opened a new window to study planning in practice and provides a fruitful area for future research and theory building on the politics of planning and mapping in southern urban contexts.

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