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Full Length Article

(Re)making hydrosocial territories: Materializing and contesting imaginaries and subjectivities through hydraulic infrastructure

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ABSTRACT

Infrastructures and their roles and connections to and in territories and territorialization processes have increasingly become objects of study in political geography scholarship. In this contribution, we build on these emerging insights and advance them by further conceptually disentangling the agential role of infrastructure. We bring together the notions of territory, governmentality, imaginaries and subjectivities, to clarify how exactly hydraulic infrastructure acts to transform relations between space, people and materiality. We start by introducing territorialization as a process of 'ordering things' in a certain space and time through different techniques of government. We then show how, at the base of such territorialization processes, are imaginaries that contain normative ideas about how space and socio-territorial relations should be ordered. Imaginaries are consequently materialized through hydraulic infrastructure through the inscription of morals, values and norms in infrastructure design, construction and operation. This set of materialities and relations embedded in infrastructure brings changes to the existing relations between space, water and people. In particular, we highlight the repercussions of infrastructure for how people understand and relate to each other, the environment, water, technology and space: in other words, how subjectivities change as an effect of hydraulic infrastructure constitution. Last, we show how infrastructure and the related hydrosocial territories that develop around it are a dynamic arena of contestation and transformation. We argue that socio-material fractures, emerging counter-imaginaries and the disruptive capacities of subjectivities constantly challenge the 'fixes' that infrastructures aim to inscribe in hydrosocial territories. Throughout the paper, we use empirical examples from recent research on hydraulic infrastructure and territorial transformations to ground the conceptual ideas.

1. Introduction: Political geography, infrastructure and hydrosocial territories

Territories, territorialization processes and infrastructures have long been topics of discussion in political geography. Originally, the notion of territory was associated with studies about state formation that understood territory first and foremost as a bounded space under the control of a nation state. Though the notion of control over socio-natural interrelations within bounded and defined geographical spaces has remained a central concern, different scholars have advanced the concept towards a notion that helps to understand the myriad ways in which actors, artefacts or other material structures and the environment interact, shape and coproduce each other within these specific spaces (Elden, 2013; Lefebvre, 1991; Marston & Himley, 2021; Paasi et al., 2022; Painter, 2010; Sassen, 2013). Discussions on territories are

therefore now about state boundaries and practices, as well as about diverse symbolic and material techniques of government, contested ontological understandings, and ordering and control of space by state and nonstate, human and nonhuman actors.

Infrastructures and their roles and connections to and in territories and territorialization processes have also become objects of study in political geography scholarship. This line of inquiry has come forth and benefited from a broader 'infrastructural turn' in social sciences. The latter has drawn attention to the relational and political characteristics of infrastructure (Anand et al., 2018; Gurung, 2021) as well as to the agentic capacities of materials (Anderson & Wylie, 2009; Bennet, 2010; Strang, 2016; Tilley, 2007). Bouzarovski et al. (2015: 217) for example show how both emerging organizational arrangements and material infrastructures for natural gas transit in Europe have created new forms of territoriality, leading them to conclude that territory is in fact a

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heterogenous “socio-technical assemblage”. Likewise, Veelen et al. (2021) mobilize infrastructure as a geographical lens to understand the practices and institutions of democracy (or lack thereof) in different places and times. These and many other contributions have been highly influential in calling attention to the politics embedded in and enacted through infrastructure (see for example Pinch, 1992; Winner, 1980) and the various ways in which territorial relations are reconfigured through infrastructure. Beyond changes in the biophysical environment, some studies have focused on how state-society relations change as an effect of infrastructure construction and how infrastructures always (re) distribute societal benefits and burdens (see for example Akhter, 2015; Meehan, 2014; Menga, 2015; Suhardiman et al., 2021). Others have demonstrated how societal norms and modes of organizing are reshaped by infrastructure, acting on people’s everyday lives and (self)consciousness in often invisible yet powerful ways (Shlomo, 2017). Most studies consider power relations as one of the key forces that shapes territories and associated processes and properties, while, at the same time, control of (or a privileged position in) territorial patterning is shown to serve as a source of power (Clare et al., 2018; Delaney, 2009; Sandoval et al., 2017).

However, we find that in these discussions the conceptualization of the agential role of infrastructure remains blurry and does not explicitly address how social, political, environmental and material relations change as a result of infrastructure construction. It is this gap we aim to address in this contribution. We do so departing from discussions on water and its governance; a field which has attracted much attention in political geography (Baviskar, 2007; Budds & Hinojosa, 2012; Karpouzoglou & Vij, 2017; Menga & Swyngedouw, 2018; Swyngedouw, 1999). Within this field we aim to answer the following question: *How does hydraulic infrastructure shape the making of territories and related subjectivities?*

Our inquiry is grounded in the theoretical advances that have been made through the notion of hydrosocial territories. As Boelens et al. (2016: 2) state in their seminal paper, hydrosocial territories are “the contested imaginary and socio-environmental materialization of a spatially bound multi-scalar network in which humans, water flows, ecological relations, hydraulic infrastructure, financial means, legal-administrative arrangements and cultural institutions and practices are interactively defined, aligned and mobilized through epistemological belief systems, political hierarchies and naturalizing discourses”.

The empirical studies that have used and further developed this approach, combined thinking on territories with other concepts such as for example governmentalities (Hommes et al., 2020; Martel et al., 2021), subjectivities (Götz & Middleton, 2020; Mills-Novoa et al., 2020; Rogers & Wang, 2020), and imaginaries (Flaminio, 2021; Rocha Lopez et al., 2019). The recognition of a multiplicity of territories within the same geographical space underpins many of these studies. Hoogesterger et al. (2016: 93) employ the terms ‘territorial pluralism’ and ‘territories-in-territory’ to describe how “diverse territories are overlapping, interacting and conflicting in one and the same geographical-political space”. This is similar to Agnew and Oslender’s (2013) examination of overlapping non-state territorialities that have emerged within simultaneously existing nation states. We build on these insights and theoretical advances to develop an analytical framework that allows for a better understanding of the role of infrastructure in processes of territorialization. We do so by bringing together insights from studies in the fields of human and political geography and science and technology studies (STS). We pay particular attention to conceptually scrutinizing how infrastructure is an attempt to fix particular imaginaries in space, and how subjects and subjectivities are (re)shaped in the process. We depart from an understanding of infrastructure as being material structures in their most obvious essence and appearance, but at the same time as contested “open-ended experimental systems” (Jensen & Morita, 2017, p. 3) that are always ‘in-the-making’. This has to do with infrastructure’s relational character: They are embedded in legal

frameworks, technical knowledge, society, political projects, world views, morals, ideology, imagination, environments and everyday practices (Harvey et al., 2017; Jensen & Morita, 2017).

Our explicit focus on *water* infrastructure allows to grasp the complexities of human-nonhuman interactions. Specifically, hydraulic infrastructure challenges us to think through infrastructure’s apparent stability and water’s inherent fluidity, and the tensed relation between these two opposing states (cf. Strang, 2011). It calls our attention to the ways in which the making and re-making of territory through infrastructure is a contested and dynamic process, in which infrastructure certainly materializes powers and socio-environmental relations but not in a deterministic, final way (Dajani & Mason, 2018). There is thus room for clarifying the agential capacity of infrastructure while at the same time acknowledging the ways in which this is negotiated by other human or nonhuman actants.

This paper builds on a review of literature about hydrosocial territories and associated notions. We draw on examples from our research on hydraulic infrastructure and territorial transformations in Turkey, Spain, Peru and Ecuador to empirically ground the discussed notions. Based on this material we disentangle infrastructure’s role in making and remaking hydrosocial territory as follows. We first draw on parts of Foucault’s notion of governmentality to show how territorialization can be understood as a process of ordering social and material relations through the application of different techniques of government; amongst which the design and construction of hydraulic infrastructure. We then review scholarship on imaginaries and argue that imaginaries can be understood as seeds that spark territorialization efforts and that subsequently become materialized in hydraulic infrastructures and new materialities. Next, we explore the repercussions that these infrastructures, and the imaginaries they embody, have for how people understand and relate to each other, the environment, water and technology. To do so, we bring in the notion of subjectivities. Finally we show that even though infrastructure may represent the ultimate attempt to fix imaginaries and socio-natural relations, such relations always remain a contested and dynamic playing field.

2. (Re)making of territory through diverse techniques of government

To grasp the territorialization dynamics associated with infrastructure, we consider Foucault’s insights on governmentality (Foucault, 1978, 1980, 2008). This allows to open the gaze to the many parallel, contradictory workings of power – specifically ‘arts of government’ or governmentalities – in and through infrastructure. This consideration is inspired by its evolving use in hydrosocial territory literature (for example Birkenholtz, 2009; Hommes et al., 2020; Martel et al., 2021; Mills-Novoa et al., 2020; Ross & Chang, 2020; Valladares & Boelens, 2019), and draws on broader governmentality insights generated in environmental studies (for example Agrawal, 2005; Fletcher & Cortes-Vazquez, 2020; Li, 2007; Singh, 2013).

In one of his first discussions on the notion of governmentality, Foucault (himself inspired by Guillaume de la Perrière) introduced the term ‘disposition of things’: “Government is the right disposition of things, [...] a sort of complex composed of men and things. The things with which in this sense government is to be concerned are in fact men, but men in their relations, their links, their imbrication with those other things which are wealth, resources, means of substance, the territory with its specific qualities, climate, irrigation, fertility, etc.; men in their relation to that other kind of things, customs, habits, ways of acting and thinking, etc.” (Foucault, 1978 [1991]: 93). What Foucault terms the ‘disposition of things’ links to conceptualizations of hydrosocial territory, especially so if we consider territorialization as the effort (conscious and unconscious) to bring about the right relationships, configurations and order of socio-material ‘things’ in a certain space.

Foucault gives interesting insights on the different kinds of ordering efforts or, in his terminology, techniques of government. First, Foucault

understands power as productive rather than destructive, which allows to set power at the core of the production, re-production and transformation of territories, imaginaries, subjects and subjectivities. Second, power is considered as relational and performative: it is not held but exercised through human and nonhuman relations and actions. In the same sense, territories are relational and performative. Rather than a rigid assemblage of ‘things’ in space and time, territory is the time-bound enactment of socio-natural relations in a given geographical space. Third, Foucault points to the multitude of techniques and forms of power that are used to ‘conduct the conduct’ of people through different forms of sovereign, disciplinary and neoliberal governmentality.

The notion of government being directed at ‘conducting the conduct’ of populations is especially insightful. It helps to see hydraulic infrastructure as an important force that structures fields of action not only in the mere material sense, but also through the creation of objects (that are acted upon) and subjects (that act upon themselves). The latter contribute to the production, reproduction and transformation of territories through their relations and understandings of each other, the environment, water, infrastructure and space. Before going into further detail about these implications of infrastructure, we first engage with the notion of imaginaries as seeds for efforts to shape territories, or in Foucault’s terminology ‘the right order of things’.

3. Imaginaries as seeds of territorialization

Imaginaries play a central role in the construction of infrastructure and the making of territories (see for example [Brighenti, 2010](#); [Fry & Murphy, 2021](#); [Raffestin, 2012](#)), and actually have a long tradition in political geography scholarship. Influential works include, amongst others, Edward Said’s *Orientalism* (1978) and Benedict Anderson’s *Imagined Communities* (1983). In the former, Said analyses how western scholars have constructed an ‘imaginative geography’ of the East, attributing simplified, romanticized and exotic characteristics to this immensely diverse geographic space. He argued, furthermore, that it was this imaginative geography that drew boundaries between an ‘us’ and a ‘them’ that reflected and further enforced racism, and served as a justification for colonialism. Through drawing this connection between imaginaries and colonialism, Said importantly showed how imaginaries have political and material consequences. Connecting to Said’s argument, a few years later, Anderson promulgated the idea of the modern nation state as an imagined political community. He deconstructed how people who do not know each other are bounded together in comradeship and a common imagined history, beliefs and attitudes through the idea of a nation and being citizens of that nation ([Anderson, 1983](#)).

Since then, various studies in the field of water governance and political geography have taken up the notion of imaginaries (see for example [Derek, 1994](#); [Harris, 2014](#); [Harvey, 1990](#); [Rusca et al., 2019](#); [Wilson, 2019](#)). In this journal, [Björkdahl \(2018\)](#), for example, shows how the Republika Srpska comes into being as a state within the national boundaries of what is officially known as Bosnia-Herzegovina in the midst of war through imaginaries and associated performative practices. [Fry and Murphy \(2021\)](#) analyse geo-imaginaries about (un)certainities and possibilities for hydrocarbon production in the Burgos Basin in Mexico. They argue that geo-imaginaries are “not just narratives and visual devices, but also forms of governmentality that aim to shape the practices, behaviours, and calculations of people in their relations” ([Fry & Murphy, 2021](#), p. 2). What stands out from most applications of imaginaries in the field of geography (for an overview and review see [Watkins, 2015](#)) is that it is mainly imaginaries about places and their characteristics (for example resources) that are considered relevant. Yet, imaginaries that have effects for the constitution of territory are not only imaginaries about places but also about populations, relations, and – importantly – in a broader sense what the ontological ‘order of things’ is and should be.

This is something that has been more explicitly analysed in science and technology studies, and then later been taken up in water

governance scholarship. Many of these studies come forth from Sheila Jasanoff’s notion of sociotechnical imaginaries as “collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology” ([Jasanoff, 2015](#), p. 4). [Barandiarán \(2019\)](#), for example, analyses how lithium and lithium extraction are imagined to foster a technologized and thus more sustainable development for Latin American countries; whereas [Perreault and Valdivia \(2010\)](#) show how social movements in Bolivia and Ecuador advance alternative imaginaries of ‘proper’ hydrocarbon governance, drawing on ideas of nationhood to seek to restore state sovereignty over hydrocarbon resources rather than oppose exploitation all together. In the realm of water governance, [Mills-Novoa et al. \(2020\)](#) analyse how climate change adaptation projects mobilize particular imaginaries of territories and subjects for intervention, through knowledge claims, techno-scientific tools (for example climate modelling and vulnerability mapping) and selective recognition of local customs that fit with the overall project narratives and objectives. In a slightly different manner, [Rocha Lopez et al. \(2019\)](#) study an interbasin water transfer and irrigation project in Bolivia as an arena of contestation between different stakeholders groups and their respective diverging hydrosocial imaginaries. These studies have shown how imaginaries are part and parcel of socio-territorial dynamics, being enacted and re-enacted through relations, institutions, knowledge claims, discourses and hydraulic infrastructure (cf. [Götz & Middleton, 2020](#); [Martel et al., 2021](#)).

What we consider of particular importance is the fact that imaginaries are inherently prescriptive and contain, amongst others, normative statements about morality ([Miller, 2019](#); [Taylor, 2004](#); [Shah & Boelens, 2021](#)). This makes them powerful vectors to shape lifeworlds and identities. When realized, institutionalized and normalized, imaginaries may become invisible and remain present as underlying, often unquestioned frames in which people understand themselves and “imagine their social existence” ([Steger & James, 2013](#), p. 23; cf.; [Taylor, 2004](#)). In that way, imaginaries provide the background within which subjectivities are formed, understood and enacted. They can thus be subconsciously present, as cognitive frames that shape everyday understandings and desires. At the same time, imaginaries can also be strategically created and mobilized to institute or contest territorial projects ([Fry & Murphy, 2021](#); [Jaramillo, 2020](#); [Meehan, 2013](#); [Swyngedouw, 2015](#)). Accordingly, struggles over territories need to be understood as struggles over imaginaries and associated identities, subjectivities and meanings that concern the wished-for hydrosocial territorial order and the ways of life that are regarded as ‘good’ and desirable (and those that are not) ([Dukpa et al., 2019](#); [Molle et al., 2009](#); [Ženko & Menga, 2019](#)).

In the case of the discussions surrounding the controversial Ilisu Dam project in southeastern Turkey, a number of actor alliances were formed that promoted specific imaginaries about the dam according to their respective background, interests and identity ([Hommes et al., 2016](#)). For example, environmental NGOs viewed the dam as extremely destructive for local biodiversity and cultural heritage. This enabled them to challenge the imaginary of the Turkish state, which envisioned the dam as a measure for securing energy and thereby related it to the energy security of the nation and development of the region. Even though, after years of discussions, the Ilisu Dam finally became constructed, the imaginaries of environmental NGOs as well as of Kurdish actors that opposed the dam inspired protest actions and managed to unite groups of people under a common banner ([Eberlein et al., 2010](#); [Warner, 2012](#)).

This indicates that, whether or not imaginaries are realized is, contingent upon a group’s ability to mobilize the necessary political, cultural, intellectual, financial and/or physical-coercive power ([Dupuits et al., 2020](#); [Hoogesteger et al., 2016](#)). Imaginaries that become materialized are not necessarily held by a majority, but may be fostered, advanced and imposed by a powerful minority even in the wake of protests of marginalized or divergent groups. Their materialization

depends on existing power relations and other contextual factors. It is thus pivotal to consider imaginaries in their linkages and embeddedness with the very particular economic and political actors and institutions that are propagating them. Likewise, imaginaries have path dependency. They are conditioned and shaped by their respective historic as well as present day socio-political and territorial context rather than emerging 'out of nowhere'. We can think about it in terms of an iterative process: imaginaries form in a particular context, reconfigure this context for example through their materialization in hydraulic infrastructure, and are in turn again changed as a result of the emerging situation. [Oliver \(2000\)](#) illustrates this in his analysis of the Thames embankment in England where the modern desire to control nature was realized in technological and hydrological designs and construction projects. Subsequently, the resulting changed landscapes shaped understandings of what is modern nature and the corresponding modern citizenship. In a similar manner, modern aspirations are generally characterized by a fascination for expert and engineering skills, and their promotion facilitates ever more complex and grand construction of infrastructure. This then again ignites and strengthens the belief in technology and its importance for bringing about 'progress'. Imaginaries and hydraulic infrastructure alike thus need to be considered in their historic context and with the particular histories entrenched in them.

Modernity stands central in many imaginaries of grand infrastructure projects such as large dams, irrigation schemes or hydropower plants. This can partly be traced back to the connectedness of large-scale undertakings with broader nation-building projects that consolidate national territory and control ([Harvey & Knox, 2015](#); [Meehan, 2014](#); [Mollinga & Veldwisch, 2016](#); [Mosse, 2008](#); [Obertreis et al., 2016](#)). Modernity in this context is often associated with key characteristics such as the belief in continued progress, the belief in planned social, ecological and technological futures, the centrality of science and technology in this planning process, and the need to control and domesticate nature ([Duarte-Abadía & Boelens, 2019](#); [Kaika, 2006](#); [Nixon, 2010](#)). Especially the last two aspects are intrinsically connected to hydraulic infrastructure as they have made it possible to enrol nature as an economic resource in intensifying and expanding modern production systems. At the base of these undertakings is a modern imaginary of nature as external to society, as disordered, savage and something to be controlled and put to productive use through advancing science and technology ([Bauman, 1991](#); [Oliver, 2000](#)). Nature is thus imagined as an entity that awaits to be mastered and turned productive for societal benefit ([Brewitt, 2019](#); [Swyngedouw, 2015](#)). Such imaginaries that envisage modernizing territorial transformations through infrastructure aim to dramatically alter the spatiality and materiality of landscapes, water flows and importantly also the social and political relations in these.

For example, in the case of the Turkish Ilisu Dam, the objectives for the construction went far beyond the straightforward goals of hydropower production and flood control: the dam construction was embedded in an endeavour to modernize the region by bringing the state's imagination of 'development' to the region where the local people had long fought for self-determination, autonomy from the state and freedom for (Kurdish) cultural expression. In this conflictive and contested environment, the construction of the dam and associated socio-territorial transformations, implied the resettlement of villages into state-designed centralized and urbanized villages. This was part of a broader strategy that aimed to control the territory, its waters, its landscape and inhabitants according to the modern imaginaries of the Turkish state ([Harris, 2012](#); [Hommes et al., 2016](#)).

4. Fixing territorial imaginaries through hydraulic infrastructure

Infrastructural systems have been long debated in philosophy of technology traditions and, more recently, in science and technology studies (STS). Studies on technological paradigms and regimes showed

how the existing technological systems constrained or enabled the emergence of new ones, creating path dependent infrastructural development ([Dosi, 1982](#)). Building on earlier critical traditions (such as the Frankfurter Schule and others), STS has analysed how technological systems are infused with politics ([Winner, 1980](#)), as well as morals, motives and ethics ([Akrich, 1992](#); [Verbeek, 2011](#)). These studies have unpacked how politics and morality are purposefully designed into material objects, devices and settings; and how technological infrastructure is deliberately used to create certain forms of social order.

The three central yet intrinsically connected questions inspiring these inquiries are: How does infrastructure come into being? What are the social, political and normative contents that are embedded and inscribed in infrastructure, steering its operational functioning (its 'contents', 'code', or overt and covert 'user guide')? And third, what are the emergent effects, once infrastructure is put in practice? ([Latour, 2002](#); [Turner & Johnson, 2017](#); [Winner, 1993](#)). In terms of the becoming of infrastructure, we want to emphasize the centrality of socio-technical imaginaries that envision the shaping of a certain hydrosocial territory through the construction of infrastructure ([Cantor, 2021](#); [Jaramillo, 2020](#); [Shah & Boelens, 2021](#)). These imaginaries prescribe who designs; what is designed; who knows/understands the infrastructure; and how and by whom the infrastructure and related water flows are operated and controlled ([Godinez-Madrigal et al., 2020](#); [Hidalgo-Bastidas & Boelens, 2019](#); [Mollinga & Veldwisch, 2016](#)). In that sense, infrastructure comes forth from, and consequently embodies material, social, and cultural relations that result from specific imaginaries. In water transfers or irrigation systems, for instance, ideas about how water should be divided, how and who should control and manage water flows is inscribed in the design and dimensioning of water control structures and canals.

When it comes to its effects, infrastructure establishes new relations between the 'things' that make up territory, (re)structuring the fields of action through material objects that change water flows and through it also the relations between society and the environment, and within society itself (as we will further elaborate in the following section). This restructuring is, in first instance, ordered by the technological inscriptions (intended and unintended) that define by whom and how infrastructure and related water flows are controlled and to what end ([Boelens, 2015](#); [Bolding et al., 1995](#); [Mollinga & Veldwisch, 2016](#)).

This connects to conceptualizing infrastructure as open-ended systems: infrastructure exists in its materiality but also in its imbrication with a multiplicity of other material and nonmaterial elements, from types of knowledge over bureaucracies to desires, fantasies and subjectivities. This is evident in the case of rural to urban water transfers – such as in Lima – where hydraulic infrastructure and accompanying institutional and legal arrangements redirect water flows and redefine water access and control in material but also in legal and institutional terms ([Hommes & Boelens, 2017, 2018](#)). Who is included and who is excluded as prioritized water user, decision-maker or infrastructure designer is defined. Likewise, desires of an urban modern lifestyle and a (material and symbolic) demonstration of the abilities of engineering are imprinted onto landscapes. En route, the environment but also political arrangements, power relations, the social and self-awareness of those involved change. These changes can be experienced on collective as well as individual levels (be it an engineer or a community member affected by the water transfers) ([Long & van der Ploeg, 1989](#); [Stensrud, 2019](#)). Thus, (hydraulic) infrastructure (re)arranges things and relations, and is therefore a particularly powerful way to materialize and fix imaginaries and related power relations in space and time. Infrastructure and the control of it are therefore key in processes of territorialization and the control of space.

5. Creating subjects through hydraulic infrastructure

Hydraulic infrastructure projects have far-reaching intended and unintended effects on 'the order of things'. They institute socio-material

objects, change institutional relations and, importantly, create subjects. The design, construction and operation of infrastructure to fix specific hydrosocial configurations in geographical space is never a standalone. Infrastructure is always embedded in a broader socio-technical system that is created to order geographical spaces and the socio-material relations that re-create a specific hydrosocial territory. To materialize and sustain this territorial fix, particular subjects (engineers, technicians, operators, decision makers, users, citizens, etc.) are needed. These (are to) enact, perform and sustain the envisaged hydrosocial territory and the relations that sustain it (Mills-Novoa et al., 2020). Therefore, powerful actors engaged in fixing specific imaginaries through infrastructure actively integrate and re-constitute new and existing subjects through diverse subject-formation strategies. These subjects are strategically aligned (included and excluded in specific roles) in the different phases of infrastructural design, construction, operation, use and maintenance (Mills-Novoa et al., 2020).

For example, hydraulic infrastructure projects are frequently accompanied by powerful discourses, which promote specific roles and conducts (for example of engineer, user-client, manager) according to a certain imagined or factual authority or system of truth (Jasanoff & Kim, 2015; Pfaffenberger, 1988). This subjectification through systems of truth and knowledge (so the bundle of selected ontologies, epistemologies and frames of meaning that establish what is legitimate, valid and true, claiming authority (Long, 2004)) is often powerful and has resonated in the work of numerous scholars. In relation to water infrastructure, Aubriot et al. (2018), Godinez-Madrigal et al. (2020), Hidalgo-Bastidas and Boelens (2019), Mollinga and Veldwisch (2016), Mosse (2008) and Shah et al. (2019b), among others, have extensively analysed how knowledge-truth politics are central in the conceptualization and implementation of large-scale hydraulic infrastructure, shaping new forms of subjectivity. These processes separate legitimate knowledge and institutional/normative frameworks from illegitimate ones (see also Boelens et al., 2019; Furlong, 2011).

Hoogesteger (2015) shows how the construction of the Pillaro-Ramal Norte irrigation system, the creation of new water users associations and related capacity building programs in the Ecuadorian Andes aimed to create 'rational' water users that would maximize production, manage their irrigation systems according to state guidelines and ensure the system's economic viability. Hommes et al. (2020) demonstrate how urban water supply projects create specific subjects before, during and after the actual physical construction: rural subjects that accept water transfers from rural to urban areas out of a felt moral obligation to not impede urban 'progress'; and urban subjects who see themselves as rightful consumers of water transferred from rural territories as imagined with abundant water resources (see also Lord et al., 2020; Meehan, 2013). In Lima, hydropower and drinking water infrastructure planning was intrinsically aligned with the broader national quest to modernize ways of life. Hydropower and water transfers were considered modern and hence desirable, just as the infrastructure that was planned for urbanization such as electrification and greening of public spaces (Hommes & Boelens, 2017, 2018). These modern imaginaries created rural and urban subjectivities based on the prescribed roles in terms of water access and use, but also forged other intimate parts of subjectivities such as desires to become part of the 'modern community' or to be regarded as collaborating citizens who do not oppose projects of national progress.

Furthermore, hydraulic infrastructure changes the physical-material environment and with it the field in which people's subjectivity becomes (Lemke, 2015). As a result, people's (self)perceptions, relations, actions and interactions – which are central to the making, upholding or changing of territories – change. This 'power to structure' of infrastructure makes it a highly moral matter as infrastructure's materiality and accompanying effects contribute to giving answers to the moral questions of how to live and how to act (Borgmann, 1995; Shah & Boelens, 2021). In other words, water technology is 'moralized', bearing its designers' class, gender and cultural norms and actively proliferating

these moral and behavioural norms when the technology is applied. Infrastructure performs as 'hardened morality' and 'materialized power' (Latour, 2002; Pfaffenberger, 1988), organizing inclusion and exclusion, enabling particular organization and behaviour, and disabling others. For instance, the canals in the upper Mantaro watershed that were constructed to transfer water to the city of Lima, cut through local communities' territories and obliged them to change livestock grazing patterns. At the same time, these canals link the highland communities to downstream water users, changing understandings (subjectivities) of belonging and position within the watersheds (cf. Hoogesteger & Verzijl, 2015). Communities are *included* in the city's water quest and *excluded* from free movement in and around the constructed reservoirs.

Hydraulic infrastructure's materiality also changes subjectivities in more indirect ways: by redirecting water flows and changing landscapes, the ways people relate to and experience their environment change. As Singh (2013, p. 191) shows, "the boundaries between the 'self' and the environment [...] [are] porous, and [...] human subjectivity is shaped by a human being's engagement with its total environment, not just its social environment". This is to say that if the environment changes, so does people's relation to it and also part of their subjectivity, depending on people's connection (or disconnection) with the environment. Verzijl et al. (2019), for example, analyse how in Cuchoquesera, Peru the meanings and relations between and among humans, the environment and the supra-natural transformed after the construction of a large dam as people gave the new infrastructure, themselves and the environment new meanings and established new relations.

Another illustration are the discussions surrounding many dam removals, which also importantly link to changing and contested subjectivities. Some parts of the population have come to regard the regulated and impounded water flows behind dam structures as a natural phenomenon, as part of local history and identity. They render any change in the human-controlled landscape by the act of dam removal as unnatural and "a moral indictment of their way of life and work" (van Wieren, 2008, p. 247). In contradistinction, for proponents of dam removal, the removal will restore nature and thereby provide a possibility to create embodied acts for "spiritual-moral meaning in relation to nature and its restorative care" (van Wieren, 2008, p. 244). This example of diverse experiences of landscapes and nature restoration points to the tension between normative and lived subjectivities (cf. Gibson, 2001), as well as to the divergent ways in which water and infrastructure are lived and experienced (Jørgensen, 2017; Vos et al., 2019; Yates et al., 2017).

6. Dynamic nature of hydrosocial territories

Though built infrastructure is an ultimate attempt to fix an imaginary and create a corresponding hydrosocial territory and subjectivities; infrastructure, imaginaries and territorial relations are constantly challenged by actors, socio-material fractures and evolving imaginaries.

6.1. Faults and fractures along the infrastructural fix

Though often pre-empted on utopian imaginaries of specific hydro-social orders, configurations triggered by infrastructure rarely materialize as planned. Contested, diverse and changing on-the-ground socio-material relations make that outcomes are more often than not unforeseen and surprising (Harvey & Knox, 2015; Jensen & Morita, 2017; Lesutis, 2021; Long & van der Ploeg, 1989). For example, Harvey and Knox in their study of Peruvian state's efforts to consolidate a national territory, conclude that the government-built roads "become part of the mundane material fabric of people's lives, producing possibilities and limitations that go beyond any specific plan for integration or connectivity" (Harvey & Knox, 2015, p. 186). Because of this unpredictability of infrastructure's effects, Jensen and Morita (2017: 6) propose to consider infrastructure as "open-ended experimental systems that generate emergent practical ontologies". They assert that infrastructure

is not simply implanted onto a tabula rasa but becomes embedded in a network of existing historical, technical, geographic, socio-political and cultural conditions and relations – with unpredictable, experimental and thus open-ended outcomes. For this reason, critical studies show how most hydraulic structures fail to perform as expected (Jasanoff & Kim, 2015; Scott, 1998). Because of social and natural alterations to the utopian plans, irrigation systems systematically underperform in terms of expected increases in agricultural productivity and irrigated area. Domestic water supply systems lose water and don't deliver the quantity and quality water that was projected. Hydro-powerplants rarely produce the promised electricity outputs. These faults and fractures come from the unpredictability of a) nature (floods and droughts, soil erosion and sedimentation, etc.), b) infrastructure and its intrinsic properties in use (wear and tear), and c) the social system that controls, manages and uses the infrastructure and related water flows. Bolding et al. (1995) for instance show how irrigation engineers in the Tungabhadra irrigation system in India engaged in a constant design and re-design of irrigation infrastructure with the aim to control the system's water flows and production. Despite of these constant efforts, the infrastructure never worked as foreseen. Water flows were insufficient, sediment loads changed the properties of the structures, water eroded, infrastructure creating leaks, cracks and new water flows. Finally local power relations and the interactions between field staff and specific groups of users led to the operation of the infrastructure with a different rationale than that of the state engineers who designed the infrastructure.

Thus, how hydraulic infrastructure is eventually embedded in territorial networks and encounters depends on various socio-natural factors that co-evolve through time. The relation between (the envisaged or actually lived) materiality or finishedness of infrastructure on the one hand, and dynamism and possibilities for contestations and adjustments (or "socio-technical tinkering" in the words of Kemerink-Seyoum et al. (2019: 4), see also Hidalgo-Bastidas and Boelens (2019)) on the other hand, is a delicate relation. For example in the Santa Eulalia watershed in the Lima region, through which a big share of the city's drinking water supply flows, concerns about climate change in parallel to an ever growing urban water demand trigger a challenging of existing hydro-social relations. Whereas in the past relations between hydropower companies and communities were characterized by compromise, communities now negotiate the distribution of financial benefits derived from the water resources. Also, the legal formalization of communal access to water has been integrated in local political campaigns, responding to the fear that water might be 'cut off' from communities if availability decreases while urban demand increases (Hommes & Boelens, 2018). Even though the concrete materialities in the watershed such as reservoirs, canals and hydropower plants have remained largely unchanged, the connected assemblages of interactions between actors, artefacts and ecology are in constant change.

6.2. Unruly subjects and changing subjectivities

Subjectivities are not unidirectionally shaped by hydraulic infrastructure, related imaginaries or governmentality endeavours. Rather, it is a dynamic and contested process in which people negotiate their subject positions, often assuming different overlapping – and at times contradicting – subjectivities (Verzijl et al., 2019). Therefore, processes of subjectification through infrastructure development should also not be understood in terms of domination or causing oppression alone. Neither is subjectification always an intentional strategy (Huxley, 2008); it can be experienced as affirming, valuable and desired as "it is, after all, what constitutes the subject" (Gibson, 2001, p. 649). In a similar vein, subjectivities are productive, not only in terms of producing behaviours, relations and experiences, but also certain forms of imaginaries. They can give rise to new imaginaries out of the creative potential, emotions, an opportune change in the broader living environment or a combination of these. This results in individuals or groups embarking on imagining and shaping alternative socio-material

realities, or even engaging in 'counter-infrastructures' to reshape hydrosocial territories (e.g., Boelens, 2015; Dajani & Mason, 2018). In the words of Gibson (2001, p. 665), referring to Connolly's work (1999, p. 146), there is always the possibility for "'fugitive energies" that exceed the fund of identities institutionally 'given' and 'assumed'" and that may result in imagining and realizing new hydro-social relations. In irrigation systems it is well known that irrigators follow their own production rationale which is not always aimed at profit maximalization. Users often tamper with the infrastructure and do not align with established authorities and normative frameworks (Hoogesteger, 2015). Canal operators and engineers adapt their functioning and that of the infrastructure and water flows to local on-the-ground realities and power relations in new hydro-social configurations (van der Zaag & Rap, 2012).

This, in fact, responds to some of the often raised criticisms of Foucault, namely that his understanding about subjectification would be 'resistant to resistance' – in other words, disallowing a subject that can transcend the regime of power. Rather (and Foucault's own counter-conduct writings exemplify this), the subject and its functioning needs to be considered as indeterminable, because of those fugitive energies but also because of its articulation with a multitude of different discourses, and its capacity to question systems of truth (Cadman, 2010; Pickett, 1996).

An instance where such processes of change and the emergence of counter imaginaries is apparent, are the discussions surrounding dam removal in Spain. The country has historically been shaped by a hydraulic mission guided to use every drop of water productively and, as a result, has one of the world's highest number of dams per capita. Today Spain is witnessing a growing civil society mobilization that calls for a new water culture and proposes the removal of dams and other smaller barriers in rivers in order to restore river connectivity (Brummer et al., 2017; Bukowski, 2017; Hernández-Mora et al., 2015). The creative potential of individual subjectivities as well as values shared among a network of people has brought forth a new understanding of socio-environmental relations in which rivers are to be (at least partly) liberated from anthropogenic alterations such as dams. The new water culture movement is broad and diverse, but interestingly includes actions directed at changing people's subjectivities, in particular the way they relate to their natural environment. In different cities, river walks are organized as embodied acts to reconnect people to their local rivers with the hope that this will change their care for water and their ideas of 'good water management' towards more nature-based approaches (Caminar El Agua, 2020). Besides changing subjectivities, this also alludes to what we touched upon above: that not only the construction of hydraulic infrastructure reconfigures subjectivities but potentially also its removal.

6.3. Alternative and evolving hydrosocial imaginaries

Imaginaries held by different actors can differ due to their diverging interests, subjectivities, ontologies and epistemologies. This leads, on the one hand, to territorial pluralism in which a territory is imagined and enacted differently within the same geographical and temporal space; and on the other hand, to contestations around imaginaries and territorial practices in time and space.

As societies change, so do ideas of modernity and progress. 'Multiple modernities' that have common overarching ideas but differential applications and interpretations, transform into new, hybrid configurations. Diverse water actors, knowledges and notions increasingly travel from global to local and vice versa, and incorporate, translate and re-articulate new forefront issues such as ecological integrity, climate change and the role(s) of hydraulic infrastructure. This query motivated us to study emerging initiatives where nature is imagined as a subject with rights ('rights of river' approaches are a clear manifestation of this, see Kinkaid, 2019; O'Donnell & Talbot-Jones, 2018)) and where different river barriers are removed (Sneddon et al., 2017). These

tendencies represent an arena of both changing modern imaginaries as well as overtaking alternative or counter-imaginaries. Dynamically, they overhaul what Scott (1998) called “high-modernism” (because of changing onto-epistemological contexts and because of changing power constellations).

Pfaffenberger’s work (1992) is inspiring to understand different types of reactions that challenge technologies such as water infrastructures. He states that adversely affected people may engage in strategies to alter either the artifact itself, or the myth and context surrounding it (Pfaffenberger, 1992, p. 282). He shows how every technology is sustained by specific myths, social contexts, rituals and discourses, which can then become contested by affected people who strive for recovering self-esteem, water access or power. For example, dominant discourses and moral norms surrounding an infrastructure might be challenged or reinterpreted so that people’s repositioning with respect to the infrastructure becomes morally possible and legitimate (Aubriot et al., 2018; Ilich, 1985; Winner, 1993). Other kinds of “counterstatements” (Pfaffenberger, 1992, p. 286) can be directed towards questioning the paradigms on which technologies have been designed, or directly aim for small-scale modifications of artefacts for example through manipulating components. Thus, struggles surrounding hydraulic infrastructure and hydrosocial territories take diverse forms and challenge different aspects ranging from the materialities of infrastructure to the imaginaries, discourses, myths, knowledges and subject positions entangled with them (see for example Duarte-Abadía et al., 2019; Shah et al., 2019; Veldwisch et al., 2009; Warner et al., 2017).

The tension between hydraulic infrastructure’s material stability and its flexibility is clearly reflected in the dynamics surrounding dam removal. It questions the status quo of dams being immovable and fixed materializations of modern socio-technical imaginaries (Brewitt, 2019; Fox et al., 2016; Jørgensen, 2017). With time passing, infrastructure aging and environmental legislation and ideas about nature-society relations (or ‘socationatures’ (Swyngedouw, 1996; cf.; Nightingale, 2018)) changing, suddenly it seems that also already constructed dams are again (and have always been) open for contestations. Such opportunities provide fertile ground for anti-dam movements, alternative imaginaries and changing subjectivities. For example, Brewitt (2019) in his study of three dam removals in the US, analyses how communities’ subjectivities have changed in the process: from communities self-defining with and through a dam that protested removal plans for many years, to communities that reconstitute their identity in terms of having hosted an iconic dam removal and thereby having contributed to herald a ‘new era’ of environmental governance. Thus, hydraulic infrastructure may be steady and stabilize a territorial order to a certain degree for some time, but may open up for discussions and shifts at a later moment when territorial networks and relations in which the infrastructure is embedded change. Hydrosocial territories, imaginaries and subjectivities are never fixed or uncontested but in a process of constant making and remaking.

7. Conclusions: making and re-making hydrosocial territories through infrastructure

The question that guided this contribution was how hydraulic infrastructure steers the making of territories and related subjectivities. Joining literature and case evidences we have brought key insights and notions, developed in parallel in different scholarly fields, into conversation with each other. Interlacing inspiring conceptual bodies that study governmentalities, hydrosocial territories, imaginaries and subjectivities helps to specify and scrutinize the diverse ways in which hydraulic infrastructure transforms relations between territory, people and materiality. Fig. 1 illustrates and summarizes these relations and processes that we have described.

This contribution furthers ongoing discussions in political geography in multiple ways. First, it has highlighted and conceptualized the central

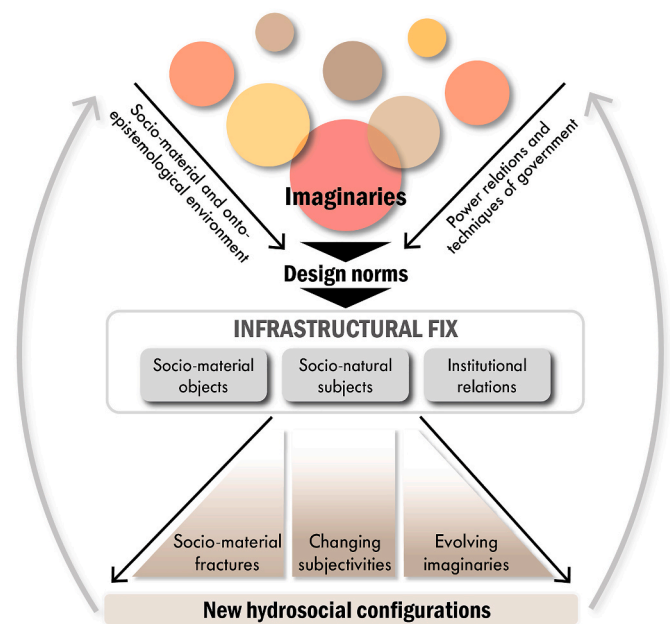


Fig. 1. Conceptual illustration of how infrastructure fixes specific imaginaries and shapes emerging hydrosocial configurations.

role of infrastructure development and decay in political-geographic territorialization endeavours. Infrastructures shape and entwine human and nonhuman entities and concerns into political-geographic configurations; relating the material and nonmaterial in particular socio-natures. This points to the importance of explicitly considering material and nonhuman concerns in political geography inquiries.

Second, through stressing human and nonhuman entwinedness, we have called attention to the interrelated ‘layers’ that are implicated in hydrosocial processes and that are spatial, material, imaginative, political and symbolic all at once. More specifically, we have argued that imaginaries are at the base of territorialization processes. This is because they encompass the framework in which life, subjects, objects and their relations are understood and lived; and because they contain normative ideas about ‘the right disposition of things’ and how these should be achieved. When fixed in space and time through hydraulic infrastructure’s designs and connected knowledges, institutions and norms; the resultant set of new materialities brings changes to existing socio-territorial relations. As we have shown, one important effect is the creation of subjects through active subjectification endeavours in the various phases of infrastructural design, construction and operation, and through environmental transformations that shape how people understand and relate to themselves, human and nonhuman others. These ‘intimate’ effects of infrastructure might be less visible than material-environmental changes, but are nevertheless extremely powerful and need to become explicitly studied and discussed in the realm of political geography.

Third, we have elaborated on the dynamic nature of hydrosocial territories and argued that the intended hydrosocial fix through infrastructure is continuously challenged. Imaginaries, hydraulic infrastructure and subjectivities are tied together in dissipative relations: stable and characterized by a certain order, but at the same time always fluid and in transformation. In that sense, territorialization through hydraulic infrastructure is not *one* specific moment in time, but rather a continuously contested process and should therefore be studied as such: throughout time and engaging with different moments.

The fluid materiality of water makes its study insightful for political geography. It provides a challenging lens to understand both the groundedness and materiality of territories and socio-territorial relations, as well as their multiple scales and dynamism. This is to say that

following water in all its territorial imbrications with humans and nonhumans, challenges us to think through the unresolvable tension between, on the one hand, the grounded and bounded characteristics of territories and fixity of infrastructure and, on the other hand, the fluidity and dynamic nature of water, society and socioterritorial relations. It is not a contradiction that requires resolving, but rather an indication of the socio-material complexity we need to recognize. As such, this contribution is an open invitation for political geography scholars and those from other related fields to apply, test and further develop the presented notions in order to scrutinize the complex role of infrastructure in the making and remaking of (hydrosocial) territories.

Declaration of competing interest

None.

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