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Abstract: Locally and globally, mega-hydraulic projects have become deeply controversial. Recently, despite widespread critique, they have regained a new impetus worldwide. The development and operation of large dams and mega-hydraulic infrastructure projects are manifestations of contested knowledge regimes. In this special issue we present, analyze and critically engage with situations where multiple knowledge regimes interact and conflict with each other, and where different grounds for claiming the truth are used to construct hydrosocial realities. In this introductory paper, we outline the conceptual groundwork. We discuss 'the dark legend of UnGovernance' as an epistemological mainstay underlying the mega-hydraulic knowledge regimes, involving a deep, often subconscious, neglect of the multiplicity of hydrosocial territories and water cultures. Accordingly, modernist epistemic regimes tend to subjugate other knowledge systems and dichotomize 'civilized Self' versus 'backward Other'; they depend upon depersonalized planning models that manufacture ignorance. Romanticizing and reifying the 'othered' hydrosocial territories and vernacular/indigenous knowledge, however, may pose a serious danger to dam-affected communities. Instead, we show how multiple forms of power challenge mega-hydraulic rationality thereby repoliticizing large dam regimes. This happens often through complex, multi-actor, multi-scalar coalitions that make that knowledge is co-created in informal arenas and battlefields.

Keywords: mega-hydraulic projects; modernist traditions; knowledge arenas; manufactured ignorance; depoliticization; UnGovernance; dehumanizing rationality; multi-actor multi-scalar alliances; co-creation; power

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1. Mega-Hydraulic Dams, Socioenvironmental Impacts and Knowledge Contestations

In 1984, Charles Perrow's book, *Normal Accidents,* was published, which has since become recognized as a classic. After its publication a series of major technological disasters occurred—the industrial chemical leak in Bhopal in India in 1984, the explosion of the US Challenger space shuttle and the Chernobyl nuclear accident in Russia in 1986. The book makes a persuasive case that we should view technological failures as a product of complex interacting systems. Perrow argued that multiple and unexpected failures are an inherent feature of complex technological systems; that these accidents are unavoidable, and even 'optimal technological designs' are unable to avoid them: they happen because of human error and organizational failure. For Perrow it is inevitable that such high-risk technological systems will eventually suffer what he called the 'normal accidents'.

This is not the place to rehearse the arguments of the book and its critiques; we evoke the book to provide a counterpoint to this special volume, which takes the opposite view to Perrow. Instead of examining the failure of complex technological systems as a matter of inevitability, and hence the end-product, we want to examine the front-end contestations of one such complex technological system that can be found all around the world: large dams and mega-hydraulic projects. Perrow takes the designs of high-risk technological systems as given. We argue that the back-end results, such as accidents, are not inevitable, and their conceptualization and production needs to be examined prior to the design process. In contradistinction to Perrow's project, we will examine how the conceptualization, design, production, implementation and operation of mega-hydraulic systems are focal points of epistemological contestation; how mega-technological systems are not a given but are socially produced and politically constructed; how mega-dams and the ways in which they are designed are not neutral, objective or 'optimal' but a biased and contextual response to particular problems that are framed and invented by a particular, and dominant, water culture. We will argue that large dam and mega-hydraulic knowledge schemes form the core of crucial power and knowledge encounters because they represent 'universalized' solutions that sideline many alternative arrangements. This special issue examines various facets of these knowledge contestations.

We propose that, explicitly or not, the design and planning of all mega hydro-technological systems involves conflicts between social groups and disputes among different knowledge regimes. In the history of debates on water governance in general, and large dams and mega-hydraulic systems in particular, such conflicts and the attendant contestation of knowledge have most conventionally been played out between water user groups (and/or dam-affected communities) and engineers or bureaucrats, for example, about a design of a dam, its location, or the allocation and distribution of water and electricity. These days, however, these conflicts around knowledge involve increasing numbers of arenas and transboundary actors, for example, multinational donor agencies, global policy institutes, international human rights courts, local and international civil society movements, indigenous groups, environmental Non-Governmental Organizations, media, government and bureaucratic agencies, experts and engineering schools, and independent scholars and activists. This makes the process far more complex. A recent example may provide an illustration:

Oroville—On 12 February 2017, Californian authorities ordered 180,000 people to evacuate their homes as the spillway of the Oroville dam was at risk of collapsing, threatening to release a deluge of water over large areas of land and thousands of houses. Built between 1962 and 1968, the 230 m high Oroville dam is the tallest in the United States. The structure is meant to protect downstream areas from floods and includes a hydropower plant.

How could this masterpiece of water engineering, that was meant to protect people from too much water, become the source of a looming disaster? The newspapers of February 2017 report that, in the first instance, it was due to extreme weather conditions—an 'atmospheric river'—that unleashed quantities of rainfall far beyond the storage capacity of the dam. As per the dam's design, the excess water was flowing over the dam's spillway. Many scientists warned that such extreme weather conditions could be expected to occur more often as a result of climate change.

While it was true that more water than usual was being discharged, the situation became critically dangerous because of a massive hole in the primary spillway and erosion in the emergency spillway. If not repaired, these could undermine the integrity of the dam. The structural state of the dam was, therefore, another cause of the threat of an emergency. Knowing that hydraulic structures like the Oroville dam have a design life of about 50 years, there are voices warning that many of America's great dams are gradually becoming obsolete and dangerous. These warnings have come from different directions. The American Society of Civil Engineers included Oroville as one of the 'high hazard' dams. As early as 2005 various environmental groups pleaded for reinforcements of the emergency spillway, but the government insisted that the dam was safe. The authorities averted the risk of dam failure by filling the hole and the emergency spillway with rocks, but it is clear that this was just a temporary measure.

Was building the Oroville dam justified in terms of historical, current and future socioenvironmental costs, risks and benefits? As all other large dams, Oroville opens our eyes to many thorny questions. How can we define and compare the, often noncommensurate, burdens and benefits? Is large dam building still a solution to claimed water scarcities, flood risks or energy shortages? Are large dams a green and safe response to multiple societal needs? Or, are they a manifestation of powerful economic, political, professional and institutional groups pursuing their interests? In such scenarios, which knowledge and truth claims are more legitimate, valid, appropriate and fair? Whose knowledge will count in the final analysis? These are not questions that should be left to engineers and politicians alone. A host of actors, including (to name just a few) environmental groups, the Native Americans who lived in the area before the dam was constructed, voters, taxpayers, local dwellers who build their homes and livelihoods near the dam site, international human and environmental rights courts—interact in this knowledge battlefield that will codetermine the future of Oroville.

The Oroville event is an illustration of the challenges and limits facing mega-dams. This special issue includes articles on the politics of contested knowledge as they become manifest in the development and operation of mega-hydraulic infrastructure projects in all continents. We witness situations where multiple knowledge regimes interact and conflict with each other, and hydrosocial realities are constructed using different grounds for claiming the truth. The concept of knowledge encounters is fundamental here. In this respect, as Norman Long argued, knowledge is a cognitive and socio-political construction that "results from and is constantly shaped by the experiences, encounters and discontinuities that emerge at the points of intersection between different actors' life-worlds . . . It is entangled with power relations and the distribution of resources . . . Hence, knowledge emerges as a product of interaction, dialogue, reflexivity, and contests of meaning, and involves aspects of authority, control and power" [1] (p. 30). Dam development interventions are focal points of intense knowledge battlefields, where entirely different, and often divergent, epistemologies interplay with, and confront each other: dominant 'expert' and multiple 'lay' forms of knowledge, beliefs and values, producing fierce struggles over their legitimation, validation, exclusion, and commensuration. In this sense, knowledge encounters around large dams combine, as objects of struggle, both the socioenvironmental issues at stake and the powerful contestation of knowledge regimes (see, e.g., [2,3]). We make particular use of Foucault's concept of power/knowledge not only to show how mega-hydraulic projects are planned, designed and constructed and what the socioenvironmental impacts of large dams are, but also to show how, and by whom, the very problems and their solutions are defined, and who has the power and/or knowledge to shape dam-related techno-political realities (see also [4–6]).

While these knowledge confrontations and epistemological encounters materialize around the construction of dams they also go far beyond the geographies of the actual dam sites: the object of these encounters and conflicts is not just the site-particular, hydrotechnological artefacts or system. As Sanjeev Khagram argues in his work 'Dams and Development: Transnational struggles for water and power' [7], behind the intense struggles over large dams, mega-hydraulics and hydropower projects there are fierce struggles among competing visions of the past, the present and models of future societal development. "A range of powerful, transnationally allied groups and organizations have historically promoted the construction of these projects: politicians, bureaucrats, landed classes, and industrialists, multinational corporations, the World Bank, and other international organizations, as well as transnational professional associations of engineers and scientists" [7] (p. 3), which he calls an informal international "big dam regime". Underlying this regime are the deeply rooted values, norms and principles that, together, have promoted a development vision that was conceptualized nearly a century ago and which has been unleashed since the 1950s and 1960s (see, in this issue [8–17]). This vision equated development as the largescale, top-down, techno-centric pursuit of economic growth through the intensive exploitation of natural resources, that commonly disregards alternative knowledge systems, development trajectories and human suffering. Nehru's dams, 'temples of modernization' were presented as bringing development for all. "Hence critics of large dam building

have had to challenge not only powerful interests and dominant institutions, but also hegemonic ideas about development in their struggles against big dam projects" [7] (p. 4).

For this reason, the contributions to this special issue highlight the multidimensionality of large dam projects; they include the power/knowledge dynamics of projects that extend far beyond 'just' water governance or water system development. In this issue, we are especially interested in addressing a number of questions. Firstly, we want to understand which (dominant and non-dominant) knowledge regimes are encountered, shaped, and validated in mega-hydraulic development. How do these knowledge regimes claim legitimacy and authority in concrete contexts? And, whose knowledge counts and whose knowledge is sidelined in particular conflict situations? We also want to examine how different "epistemic communities" are formed in relation to design, planning and construction. And, how race, class, caste, ethnicity and gender as well as professional identity interplay and influence the formation of epistemic communities around dams and mega-hydraulics. We also want to address the historical and contemporary processes of how both dominant and contested knowledge are formed, how they (interactively) shape norms, rules, beliefs and values about water problems and solutions, and how they become embedded in material artefacts. This includes the ways in which societal values (for instance, notions of justice, citizenship, progress, and democracy) are deployed and coproduced in the contested epistemologies on large dams and hydraulic infrastructural development projects.

In the following section we first discuss how mega-hydraulic projects, despite international critique and a temporary withdrawal of multilateral funding agencies, have recuperated their prominence worldwide. Here we also discuss how 'the dark legend of UnGovernance', as the epistemological backbone of mega-hydraulic regimes, makes invisible the world's diverse water cultures, imaginaries and hydrosocial territories. In Section 3 we show how this results in modernist regime practices that subjugate other knowledge systems and dichotomize civilization and backwardness. Sections 4 and 5 discuss how mega-hydraulic epistemic systems and methods depend upon depersonalized water planning models, whereby manufactured ignorance (including manufactured risks) is inherent to designing and implementing large dam projects. While showing the intricacies of how dominant mega-hydraulic rationality shapes values and artefacts, in Section 6 we also warn against romanticizing and idealizing local and indigenous knowledge, which paradoxically can seriously threaten dam-affected communities. Sections 7 and 8 detail how dam-related knowledge is typically produced in arenas that become battlefields; we examine how multiple forms of power are involved in the efforts to challenge and (re-)politicize large dam regimes and projects, increasingly manifested in and through complex, multi-actor and multi-scalar coalitions.

2. The Return of Mega-Hydraulics: Modernity and Control over Nature

Hydropower and other mega-hydraulic projects have long been a deeply controversial issue, generating intense local, national and transnational disputes among proponents and opponents. Large-scale water infrastructure development has been shown to generate profound social and environmental impacts, the more so since the burdens and benefits are unevenly distributed among population groups and locations [8–17]. Commonly, mega-hydraulic projects aim to supply water and/or energy to industrial growth sectors, large-scale capitalist export agriculture, and the growing thirst of mega-cities and urban zones [18,19]. As Duarte-Abadía et al. [20] (p. 244) note, mega-dams grossly change hydrological regimes and tend to irreversibly alter the ways in which local communities are able to make their livelihoods. Fainguelernt explains how, characteristically, the Belo Monte hydropower dam in the Brazilian Amazon, the third largest in the world and an icon of the modernist-developmentalist model, " . . . disrespects Brazil's environmental legislation and the rights of indigenous populations, who are considered 'hindrances' to economic development" [21] (pp. 257–258). In many places, people affected by a hydropower project, through dispossession, expropriation or resettlement—have been left on their own, bearing the burdens but receiving no benefits ([22–26]).

The grassroots, activist and academic worlds have not remained silent. Over the past few decades, mega-hydraulic interventions in local territories and hydrological regimes have received growing media attention, scholarly scrutiny and public critique, all denouncing the multiple ways in which they generate environmental damage and human suffering. They have also been characterized as icons of civil engineering, top-down and supply-side water resource development [27–31]. Mehta [32,33], Swyngedouw [34], Hommes and Boelens [35] and Lynch [36], among others, explain how this dominant techno-economic regime's narrow epistemic focus on a few issues such as 'solving water scarcity', actively legitimizes capital-intensive supply-side investments (the dams). Paradoxically, rather than solving water scarcities the regime often, not just discursively but also materially, actually produces them, by fiercely promoting the expansion of multiple, high-consumptive water use sectors (see also [37–41]). As Mehta argues: "The extra-basin transfer of water from large dams is often considered the only way to mitigate the problem of water scarcity in semi-arid and arid areas, despite the counter-evidence discrediting them . . . Such narratives tend to serve certain socio-political agendas and/or reflect the worldviews of their advocates instead of being rooted in local realities . . . Scarcity is essentialized and naturalized" [32] (pp. 2037–2038).

Despite several decades in which mega dams were subject to widespread critique on social and environmental grounds, which led for a while to the withdrawal of international policy institutes and funding agencies from backing such projects, hydropower and large dam development have recently made their worldwide comeback [19,42,43]. Amidst rising awareness about climate-change, hydropower dams, in particular, are presented as key solutions that support the transition towards new 'green economy' and 'clean development' [25,35,42,44,45]. Menga and Swyngedouw [5] show how the hydropower industry, which in the last two decades of the 20th century had become highly controversial, has re-established its dominance as the world's main renewable energy source since the early 21st century. This trend is most notable in emerging markets of the Global South. They cite the World Energy Council figures for 2015, which state that 76% of all renewable electricity comes from hydropower plants [5]. In a similar vein, Barbara Lynch [15,36] argues that " . . . criticized in the 1990s for its initial investment in the Chixoy, Narmada, and other ill-conceived dam and hydro-electric projects, the World Bank moved away from lending for big infrastructure projects. But by 2003, it had returned to its eagerness to fund big dam and water transfer project developments" [36] (p. 74). As Hommes et al. [43] argue, dam development has been reinvented and reframed in a renewed, strongly depoliticized language of overall progress, sustainable, clean development and efficient, rational water management. "This disregards competing claims and conflicts over water, landscape and hydropower development and assorted interrelated struggles over socio-cultural issues, problem definitions, knowledge frameworks, ontological meanings, decision-making and preferred solutions" [43] (p. 11). One commonly finds that this powerful new mega-works discourse ignores the lessons of the past decades and neglects large dams' negative contribution to climate change [25,46]. At the same time, grassroots organizations, displaced communities and indigenous protestors are increasingly criminalized and violently oppressed for defending their land and water rights (see, e.g., [15,42,47–49]).

These dams are promoted by 'hydrosocial networks' consisting of State bureaucrats and politicians, engineering schools, transnational consultancy firms, construction companies, investors and funding agencies, who decisively prioritize mega-hydraulic development over interactively designed, context-specific and less expensive alternatives. They discredit proposals that facilitate local control of water resources, embedded cultural practices and sustain existing livelihoods [50–52]. They are part of, and contribute to, capitalist/market based economic growth and support the process of resource accumulation by elites [6,25,52].

The big dam regime builds on a modernist epistemological discourse, which is importantly founded on what Boelens [53] called the "Dark Legend of UnGovernance" (or "UnGov Legend"), involving a deep, often subconscious, neglect of the existence of multiple hydrosocial territories and diverse water cultures and societies. This untold legend claims that local water territories are

basically unruly, consisting of " . . . disorganized humans, irrational values, unproductive ecologies, inefficient resource use, and continual water conflicts. The UnGov Legend disfigures water societies by overlooking water users, meanings, values, identities, and rights systems on the ground. It then constructs its own water users, with identities that conveniently fit the models, with needs and rationales matching the imaginations of those in power, shored up in their science, technology and policy towers . . . " [53] (pp. 7–8). The UnGov Legend presents mega-hydraulic projects as being entirely coherent, benevolent, shedding light in the darkness and bringing rational order to the water regime. This means that modernist water governance models, as national and international mega-hydraulic policies and plans and State- and market-based water laws, do not need to adapt to the realities and practices of local populations. On the contrary, it is these local populations who need to adapt, not the plans. These modernist models seek to create their own, utopian, water world [39].

In a similar vein, Worster [31], Blackbourn [54], Kaika [29], Swyngedouw [55], and Boelens and Post Uiterweer [50] relate how, following 'the dark ages' of feudalism, colonialism and other forms of dystopian, structural, chaos, large dam building projects are presented as 'utopian techno-political arms' that will bring order to a disordered society and nature, and help to build new nations. Nixon states: "Megadams served as highly visible, spectacular statements that new nations were literally soaring toward development, by mastering rivers and reaching for the sky. Constructions on such a scale rendered material the trope of nation building: to erect a megadam was literally to concretize the postcolonial nation's modernity, prosperity, and autonomy. Each dam was simultaneously an act of national self-assertion—independence writ large across the landscape—and an act of natural conquest" [56] (pp. 65–66). Nixon [57] and Watts [58] also refer to the dominant, dark legend that legitimizes the epistemologically imagining of communities and the physical transformation of territories to fit the new extractivist, order that supports the construction of mega-dams. The flipside of this is that it also involves the active "un-imagination" and erasure of communities, knowledges, places and livelihoods that do not fit the model. "The idea of the modern nation-state is sustained by the production of imagined communities but also by the active production of unimagined communities", that is, "communities whose vigorously unimagined condition become indispensable to the maintenance of a highly selective discourse of national development" [56] (p. 62). The Dark Legend of Ungovernance [53] converts inhabitants of so-called 'hydrological zones' into "uninhabitants [. . .], the convergent unruliness of 'irrational' river people and an 'irrational' river must be straightened out and channeled into a national culture of rational development. We thereby witness a combined assault on an 'unregulated' river and purportedly 'lawless' people . . . " [56] (p. 74).

Other mainstays of the big dam regime's modernity project also merit scrutiny. There are, obviously, "multiple modernities" [59] and the dam regime, its imaginaries, designs and practices are not monolithic: large-scale dam development's techno-political-economic power grid requires, builds on, and fosters 'thinking globally' but in order to be successful its need to mediate and engage with diverse localities, producing complex and sometimes divergent capitalisms. This means that modernization pushes in particular directions that steer hydro-territorialization in response to locally prevailing structural forces, contingencies, multi-scalar relationships, multiple knowledgeable social actors [1,60] and their complex interaction with socio-natural actants [61].

Nevertheless, we can find commonalities and characteristic features within modernist large dam development. The neglect or dismissal of the old, the past and of existing cultural and ecological diversity is one key element in constructing the modernist discourse. The emphasis on man's agency and ability to actively shape the physical and social environment and ability to construct their life and water worlds is another fundamental aspect. This reflects (and advances) the passage from one development stage to the next improved one, as epitomized in in 1960 in Rostow's classic (but widely discredited) 'stages of development' [62], where 'natural states of underdevelopment' simply require a big push to fast track onto a linear trajectory of evolutionary modernist development. The realization of large dam projects heralds a step towards civilization, which radically both changes the physical environment and reconfigures 'primitive' social structures. This view not only sees traditional

societies as in need of being modernized, but sees nature as the Other, non-human, disordered, and savage: something that needs to be conquered, colonized and subjected to humanity's will and benefit [29,31,54,63,64]. One implication of this is that the mega-hydraulic modernist discourse inherently entails an epistemological and ontological divide between society and nature [61,65].

Other intrinsically related features of the modernist paradigm in large dam development include:

- 'De-rooting' the past, and ahistorical views that stress 'making a break' and discontinuity (in order to achieve development);
- The deep-grounded notion of the plannability of socio-natural futures;
- The need and possibility of reducing diverse cultural meanings, values, language and knowledges to a single rubric, in order to arrive at one common metric ('commensuration');
- The objectification of social values and relationships and the calculability of societal choices and preferences in order to derive socially engineered optimal outcomes;
- The deployment of instrumentalist rationalities that enable a universalist water governance culture, and;
- The commodification of nature and society in order to justify large-scale hydro-territorial development.

In addition, as Polanyi [66] argued, the modernist paradigm also assumes that the formal economy exists separately and independently of the societies and cultures in which it is embedded, while it can and should be based on the principles of extractivism, appropriation and productivism [64,67,68].

In line with Scott's notion of 'high modernism', the modernist large dam development paradigm entails a local-global project founded on "supreme self-confidence about continued linear progress, the development of scientific and technical knowledge, the expansion of production, the rational design of social order, the growing satisfaction of human needs, and, not least, an increasing control over nature" [69] (p. 89). This rational design of social, political and cultural order, commensurate with the laws of natural science, entails standardizing the subjects of development and eliminating attributes that are considered "situated", "deviant", and "contextual" [70]. Modernist water governance and dam development, thereby, entail power relationships and strategies that seek to produce a particular hydrosocial order.

Therefore, hydromodernity is an inherently socio-territorial project [44,52,71]. As Hommes et al. [43] argue, mega-hydaulic projects " . . . entail discourses implying concealed efforts to reconfigure existing socio-natural relationships and implant new meanings, values, distribution patterns and frames of rule-making and alignment; they aim to build profoundly new 'territory' matching powerful ruling group interests to self-governing citizens" [43] (p. 18). Large dam schemes connect the social and the natural in specific ways, and they construct precise patterns as to how water should be stored and distributed and how humans and non-humans need to be ordered in socio-technical hierarchies. They legitimize this through moral and symbolic orders that strengthen the status quo [52,72]. In other words, mega-hydraulic projects fundamentally (re-)configure hydrosocial territories (Boelens and colleagues [73] (p. 2) conceptualize the hydro-social territory notion as "the contested imaginary and socioenvironmental materialization of a spatially bound multi-scalar network in which humans, water flows, ecological relations, hydraulic infrastructure, financial means, legal and administrative arrangements and cultural institutions and practices are interactively defined, aligned and mobilized through epistemological belief systems, political hierarchies and naturalizing discourses"). This is not just a 'social affair': mega-dam based reterritorialization projects entail efforts to embed these new knowledge contents, principles, social–political norms, morals and hydro-cultural relations in material infrastructure, artefacts and technological network relationships. That means that these projects involve the 'moralization' of (hydro-)territorial infrastructures. As 'governmentality' endeavors, " . . . dominant hydrosocial configurations commonly curtail local sovereignty and create a political order that makes these local spaces comprehensible, exploitable and controllable" [43] (p. 11).

In fact, large dam knowledge encounters powerfully produce new (and always contested) social and symbolic materialities (cf. [74–79]).

3. The Civilized Self and the Backward Other: Battlefields of Modernist and Subjugated Knowledges

Throughout the world, the conquering of nature and the ordering of humans and ecology through large dams, reservoirs, tunnels and canals, to take water from the 'backward rural areas' to 'modern urban metropoles', has invoked utopian-inspired exaltations of modernity, civilization and progress [31,45,80]. Several papers in this special issue [9,11–17] detail how mega-hydraulic projects shape and materialize visions about technological and economic modernization, the mastery of territories and natural resources, and, as Teräväinen frames it, enhance the nation-state's depoliticized, techno-scientific knowledge base.

Lena Hommes describes how in Peru, for decades, water transfers from the remote highlands to the desert city of Lima have been framed in terms of enlightened utopianism, combining hydraulics, a civilizing mission and the disciplining of nature and humans (cf. [81–83]; see also: [31,44,50,84–86]). One of the national newspapers glorified Lima's water works in the following way: "Men's labour has dominated the landscape and regulated raging torrents. Works of civilization in its most exact sense: dominance and utilization, so the true conquest for the community's benefit. [. . .] Great victory for men, their science and determination!" (all quotes from [35,45]). The hydropower company adds that: " . . . transforming the dramatic topography of the Andes—a hostile barrier to Peruvian man and his life needs—is an idealistic goal and driving force of progress for a beautiful metropolis". In the same way, the Swiss co-financer praises the "technical means that liberate men . . . giving them a better opportunity to develop their personality and soul, to become a higher class of human being, more intelligent and technically better equipped to live peacefully in the future". Mega-hydraulic designs *'liberate by dominating'*—Peru's water engineering echoes George Orwell's linguistic inversions in 1984 Newspeak—they domesticate landscapes and water, but also Andean highland villagers. As Hommes' studies show, to justify transforming the highlands of the Andes, affected communities are presented as in need of civilizing. Hydropower's mission is to tame savage waters (the enemy) and save rural people from the dark, as an admirer of the water transfers and hydropower development expresses " . . . to enrich Lima's watershed from the virgin highland sources, full of wild waters and lagoons. A tremendous, frightening battle against an enemy that wouldn't bow down: the water behaved in outright confrontation with those water seekers—a heroic deed by the technicians" (from Buse's 1965 book «*Huinco 200,000 KW*», [35] (p. 71)).

Modernist firm belief in dichotomies, which also finds expression in opposing the highlands' abundance to the civilized megacity's lack of water, justifies largescale water extraction. Obsolete, leaking water infrastructure inside the city itself and huge water abundance, squandering and over-allocation to Lima's elite sectors—with filled swimming pools and intensively irrigated parks—is discursively obscured. Water scarcity, politically constructed in poor neighborhoods, is presented as nature's fault and a result of the surrounding desert, climate change and weather conditions, all of which legitimize mega-hydraulic water transfers that would supposedly 'benefit all'. And while massive investments of cash and engineering skills are made in channeling water to Lima, benefits for local highland communities remain limited [35,45].

Large dam regime's modernist dichotomies not only divide nature and society by portraying nature as the savage Other; in order to justify water extraction and territorial transformation, there is also a need to dichotomize rural backwardness and city life's civilization. As Hommes describes, the hydropower company's brochure contrasts a power line, symbolizing progress, with a llama, symbolizing Andean communities' backwardness [45]. This follows the historical discourse in which Indians are represented as 'talking llamas' [4]. A book published by Lima's drinking water utility, entitled *Land of the Lagoons*, reflects this ingrained paternalism: "Living in a natural paradise, these communities are at a distance from our country's reality and necessities. Accordingly, they showed

indifference towards the great project that will benefit the regions of Lima and Callao with new water sources [...] Nevertheless, explaining the project's kind-heartedness conquered their resistance" (quoted by Hommes and Boelens [35] (p. 77)).

More generally, since the mid-20th century, development institutions and policies have emphasized this dichotomy between subject and object to justify 'superior' modernist knowledge/technology interventions; for this, they even created the subject as an object of intervention. As Michael Kearny argues: "With the disappearance of 'the primitive', 'the peasant' increasingly came to typify the generalized Other, but an Other seen not as primitive nor primordial but as 'underdeveloped'. This 'underdeveloped peasantry' thus became an inversion of 'the modern,' a new objectified and contrasting Other ... " [87] (p. 35). In a similar vein, Ivan Illich [88], in his famously provocative style, once typified the stages in which the Other's values, needs and (non)knowledge have been constructed historically by the West, not with the intention to reflect reality but to foster the latter's own political projects. "Each time the West put a new mask on the alien, the old one was discarded because it was now recognized as a caricature of an abandoned self-image. The pagan with his naturally Christian soul had to give way to the stubborn infidel to allow Christendom to launch the Crusades. The wild man became necessary to justify the need for secular humanist education. The native was the crucial concept to promote self-righteous colonial rule. But by the time of the Marshall Plan, when multinational conglomerates were expanding and the ambitions of transnational pedagogues, therapists and planners knew no bounds, the natives' limited needs for goods and services thwarted growth and progress. They had to metamorphose into underdeveloped people" [88] (pp. 94–95) (see also [89]).

Indeed, throughout history, similar cultural-political constructs have been purposely invented for subordinating (or, on the contrary, reifying) the Others' identities, property relationships and knowledge systems. This prepared a valuable way for experimenting with how to organize people and property: presenting a civilized Self versus a barbarian Other. The West was unaware of non-Western governance and knowledge frames and so invented myths about them, to justify invasion and to introduce order to the ungoverned. The actual people and their forms of natural resource governance were conveniently ignored.

Ignorance of the diversity of governance and knowledge forms involves erasing localities' place-making, place-experience and meaning-giving—"local knowledge is a mode of place-based consciousness, a place-specific (even if not place-bound or place-determined) way of endowing the world with meaning" [90] (p. 153). Or, as Illich tellingly explained in *H₂O and the Waters of Forgetfulness* [91], the vernacular understandings and meanings of 'water' are always related to 'dwelling' and (highly dynamic) place-based experiencing. Similarly, Tim Ingold talks about local knowledges as "dwelling perspectives" [92] (pp. 153–154). By contrast, as we have outlined above, modernist mega-hydraulic discourses depict locally existing systems as representing disorder, ignorance and lack of governance. Characteristically they deny existing places (or, as Lefebvre [93] and Bauman [64] argue, they aim to replace them by an empty or fluid 'space'). As Barbara Lynch commented on the Chixoy Dam Project in Guatemala, " ... in the process of (the) production of space, place was erased, first conceptually and then literally. Components of place that were obliterated in the transformation of the project area included its connection to ancestors, sacred elements in the landscape, the knowledge that resides in (the) landscape and its features, relations and networks of economic interaction, and knowledge about safety and danger" [70] (p. 15).

But beyond just aiming to obliterate such vernacular, locally embedded knowledge, modernist governance ideologies and strategies are Janus-faced: in addition to stressing the "radical differences" with the communities that need to be displaced and unimagined, they strategically and simultaneously adopt a liberal discourse of integration and participation, which *will include* peasants, indigenous and lay cultures and knowledge as "potentially equals" [4,53]. They are potentially equal, have the right to be equal, and should be equal. This complementary face of modernist water policies is based on 'equalizing expansionism', not on violent conquest but on universal water rationality.

Modernist water science and policy projects churn out recipes by 'certifying good water use': new water knowledge, rules and identities for becoming equal. Water cultures are judged (and made to self-evaluate) how well they meet these standards. Failure to meet these 'self-evident' principles is presented as a lack of capacity for reason and unwillingness to progress. Modern water resource policies promise to accelerate 'progress' through planned development and guarantee control over nature through advanced science; material wealth through superior water technology; and effective, good governance through the rational organization of water users. The idea is that local imperfections and inefficiencies, just like cultural differences, will disappear as people realize the effectiveness of rational, modern experts' capacity to meet water development needs.

In this Foucauldian game, mega-hydraulic interventions and water training projects exercise power that constantly generates new water knowledge. And, in turn, official water knowledge continually reinforces powerful hydro-political configurations. As Foucault stated, power and knowledge depend on each other: power cannot be exercised without knowledge, and knowledge necessarily engenders power [94] (p. 52). In this politics-of-truth, modernist water science, water governance and mega-hydraulic policy-making produce permanent, clear results, separating legitimate forms of water knowledge and rights from illegitimate ones. Power, thus, makes claims on reality, knowledge and truth, and even determines the ways in which 'truth is made true'. Foucault: "Truth is to be understood as a system of ordered procedures for the production, regulation, distribution, circulation and operation of statements. Truth is linked in a circular relation with systems of power which produce and sustain it, and to (the) effects of power which it induces and which extend it. A regime of truth" [94] (p. 133). Thus, through endless 'degrees of validity', valid water knowledge—although profoundly normative—is objectified and judged according to its deviation from the (hidden) norm or standard: efficient water use, effective infrastructure, productive irrigation systems, rational water rights, equitable water allocation, best watering practices, democratic water governance, sustainable water development, modern water users, and so on [4]. This entirely depoliticizes 'truthful knowledge', and the agents and relations that set the standards. The language of modernist mega-hydraulics actively subordinates the variety of existing knowledge claims about, and practices related to, water control and territorial rights to its functionalist, universalist, epistemology. Foucault [94] (p. 82) would frame the latter as sets of "subjugated knowledges" that are disqualified, hierarchically seen as inferior, and noncompliant with the required levels of cognition or scientificity. They are to be invaded and re-arranged by expert-thought and scientific/formalist thinking.

Foucault [95] identified four interrelated ways through which dominant knowledge projects discipline and control existing knowledge regimes and eradicate "false or non-knowledges" (that is, the non-compatible and non-commensurate knowledges): (1) selection; (2) normalization; (3) hierarchization; and (4) centralization. These processes are highly applicable to mega-hydraulic interventions in local, complex hydrosocial territories. Large-scale hydraulic projects that entail knowledge encounters conform perfectly with Foucault's description [95] (p. 179) of how "bigger, more general, or more industrialized knowledges, or knowledges that circulated more easily . . . annex, confiscate, and take over smaller, more particular, more local, and more artisanal knowledges". In a first stage, this is done "by eliminating or disqualifying what might be termed useless and irreducible little knowledges". Second, "by normalizing these knowledges, this makes it possible to fit them together, to make them communicate with another, to break down the barriers of secrecy and technological and geographical boundaries". Importantly, "this makes not only knowledges, but also who possess them, interchangeable". Thirdly, "the hierarchical classification of these knowledges allows them to become, so to speak, interlocking". Next, finally, dominant epistemology builds a "pyramidal centralization that allows these knowledges to be controlled" (all quotes from Foucault [95] (p. 180)). Foucault is describing the battle for truth, the struggle over "the ensemble of rules according to which the true and the false are separated. . . . It is not a matter of a battle 'on behalf' of the truth but of a battle about the status of truth and the economic and political role it plays" [94] (p. 132).

4. 'Dehumanizing' Rationality and Manufactured Ignorance

The modernist-scientific project needs to be 'objective', to keep a distance, and to avoid emotional contacts with the common people. This keeps most hydro-technological scientific research, hydraulic development, water governance and policy formulation from *feeling* what is actually happening, or from imagining what *could* happen in the hydro-territorial realities in which they are intervening. In this way, most dam-development expert institutions and funding agencies can more easily make far-reaching decisions about other people's lives. As Gunter Anders remarked, "the larger the distance, the proportionally smaller our capacity to imagine, and the less our actions are restrained" [96] (p. 15). In modernism's enlightened science and policy-making, knowledge, empirical perception and intellectual understanding are separated from the ability to creatively *imagine* human and non-human consequences (Anders argues that 'knowing' is not sufficient and that it "is the weakest existing form of involvement" [96] (p. 138)). In this respect, mega-hydraulic epistemic communities use 'puppet-based' depersonalized water planning models that, in fact, dehumanize water development and, as a result, avoid addressing the political roots of the problems of water scarcity and overabundance. As Boelens observes, "Water science and policy model-making ivory towers largely combat the generalized Water Crisis by inventing a 'hydro-political dream scheme'—an idealized socio-technical order aligning humans and non-humans—obscuring (the) day-to-day consequences of these policy models for real flesh-and-blood men and women" ([4] (p. 197). See also [97]). In this vein, the international consultants and academic directors of the new hi-tech Yachay University in Ecuador (ironically, *yachay* means 'knowledge' in the indigenous Kishwa language) explain that technology/knowledge development does not need adaptation to local society but that society must fit to new, external highly modernist knowledge: "If we can transform their lives by lightening their imagination (then) we will have engendered a new society based on science and technology . . . We endeavor to make Yachay change the 'chip' of Ecuadorian mentality, the way in which Ecuadorians see life" (Vistazo, 2014:13,14,16, in [98]). Such epistemology absolutely ignores human diversity, and local water identities and the complexities of territorial water rights systems. Standardization and universalization equalize human actors and relationships, taking the dominant (mostly white, male, occidental, privileged class, and/or non-indigenous) as the referent. "Overlooking differences among actually existing water users and rights systems, generates biased user and rights representation, active commensuration, and thereby indifferences regarding real-life users and rights. Seen from high above, from the towers of indifference, everybody is equal and made equal" [4] (p. 197).

The modernist water policy modeling and mega-hydraulic engineering activities, which follow universalistic guidelines for building hydro-political dream schemes, lack the empathy to understand the very real concerns about their socioenvironmental impacts. They stimulate ignorance and an incapacity to think about the motives and effects of (technical and social) engineering decisions, which leads to indifference, and a neglect of actual consequences of their actions. The evaluation and reporting of the results of dam projects correspond to theoretical disciplinary assumptions and ignore multi-dimensional realities. The institutional and economic incentive structures (and even scientific credit systems) that support large dam projects carry no obligation to focus on the actual impacts in the hydrosocial territories, inhabited by real people. 'Success' is separated from real improvement as judged by local villagers and water users.

The power of ignorance, both conscious and unconscious, and its impacts, are fundamental to large dam building. Nikhil Anand [99], studying water supply in Mumbai, argued that, 'ignorance' plays as important a role as 'knowledge' in hydraulic engineers' claims of good water governance. 'Active ignorance' or 'consciously not knowing' goes beyond the arguments about the inevitability of failure embodied in mega-projects advanced by Perrow [100] (and discussed earlier in this article). It is better captured in the thinking of Nobel Prize-winning economist Albert Hirschman, progressive intellectual, activist, policy thinker, and World Bank consultant. In the 1960s, Hirschman was appointed to evaluate projects funded by the World Bank in many countries around the world. Barbara Lynch [15], in this volume, discusses Hirschman's argument about what he called the "*hiding hand*"—how the

unknowns, hidden uncertainties and unpredictability in the planning of mega-projects, such as large dams, fosters decisiveness and creativity by deluding the project planners about the potential difficulties that the project will inherently encounter. Along much the same lines as Perrow, Hirschman argued that the planning of complex technological systems inherently, and inevitably, contains a high level of uncertainty. Whereas Perrow argued that this unpredictability would inevitably result in accidents (and hence was inherently dangerous) Hirschman argued the need to embrace this unpredictability, since knowing or imagining all the negative future scenarios beforehand would hinder the execution of all large-scale project and so, 'development' and 'progress'. Lynch directs a powerful question, and implicit critique to Hirschman, which should also be directed to Perrow. Should one close one's eyes to potential human and environmental suffering? And is ignorance (i.e., uncertainties and unpredictability—as in Perrow) about such difficulties merely a chance or coincidence, or is it systematically produced? Lynch discusses two projects, the San Lorenzo dam in in northern Peru (which was Hirschman's original case study) and the controversial Guatemalan Chixoy Dam and argues that the hidden costs and suffering were not inadvertent, but came about as a result of a systematic production of ignorance. Manufactured ignorance in the planning process enabled international donors and other actors to disregard genocide, the systemic state-sponsored military campaigns against the indigenous Maya populations (see also [22,47,70]. Lynch makes a compelling case that it was not uncertainties and unpredictability, but the pattern of manufactured ignorance that guided the development of the projects and that this pattern was supported by the international mega-hydraulics culture of donor agencies, contractors, and experts. Lynch also argues that the Chixoy Dam project was not an isolated instance of development miscarried or a case of unintended side effects, but came about through the deliberate exclusion of the voices of the people affected by the project. This ignorance was followed by the exclusion of contextual evidences and local knowledge, which ultimately shaped how 'valid knowledge' was defined and accepted among these development actors. Some other scholars have also argued, contrary to Perrow, that the damage caused by dam disasters is often not unavoidable or unforeseen but instead allowed to happen [14,49].

The production of ignorance is an issue that is fundamentally neglected in studies of mega-hydraulic projects and large-scale territorial transformations (see also [101]. Proctor and Schiebinger [102] argue that a great deal of attention has been given to epistemology—the study of how we know. Sismondo [103] (p. 169) goes further, arguing that the entire discipline of science and technology studies is focused on knowing how we know and neglects the equally important question of what, how and why we don't know things. Ignorance is commonly seen as an absence of knowledge, something that needs correcting. It may even be interpreted as uncertainty or unpredictability (as Hirschman and Perrow do, in their own distinct ways). But as large dam developments have deep cultural, socioeconomic, psychological, environmental and political impacts, we also need to think about the conscious, unconscious and structural production of ignorance [102]. Lynch's contribution to this volume [15] powerfully shows how ignorance is a resource, a selective choice, a strategic play and an *active construct*.

Fox and Sneddon [11], in this volume, illustrate this point by providing glaring examples of such ignorance being strategically deployed for political ends—for instance, Cambodian Prime Minister Hun Sen, after visiting the highly contested Don Sahong dam (then being constructed in the Mekong river basin) said: "I visited the dam and it does not have any impacts". They discuss in detail the extensive body of evidence showing that this dam will have significant negative impacts, including the displacement of communities and threatening fish production and food security in the region. This systematic production of ignorance is not only promoted by government officials but also supported by the extensive involvement of experts. The Laos Ministry of Energy and Mines, involved in the project, promotes a narrative of hydropower as embodying sustainable development, verified through "consultation with experts". Fox and Sneddon asked why experts have such a prominent role in the face of the mounting conflicting evidence that has been painstakingly collected by local residents, NGOs and independent scientists. This leads us to argue the need to rethink the role of experts in the

building of large dams since, most often, their technical and moral decision-making capacity 'is not relevant to the locally specific contexts in which they intervene': contexts that they may know nothing about and to which they may choose to turn a blind eye. In Gunther Anders' words, their schemes are based on profound 'subject- and fantasy-loss' [96].

5. Manufacturing Risks, the Commensuration of Values and Calculating Compensation

Given the colossal (foreseen or hidden) impacts of dams on nature and society, the calculation of risks and damage and the provision of adequate compensation for the later are crucial, controversial, yet also highly neglected issues. We want to highlight how manufactured ignorance is connected with manufacturing risk. Huber [14], in this volume, shows how willful ignorance regarding hydropower risks—a result of institutional complacency, technological hubris and manufactured uncertainty—contributes to the unequal production of risk, and the associated processes of marginalization and facilitation. Huber's paper links the issues of inequality and risk. She narrates the everyday experience of "ecological precarity" caused by the construction of hydropower infrastructure in fragile ecological settings, such as the Himalayas. She found that it is the poor people, with limited means, who suffer from the sudden appearance of cracks in their houses, the occurrence of landslides, or the sudden drying up of springs or declining soil moisture in agricultural land. It illustrates how environmental governance in the Indian state of Sikkim—an interplay of institutional mechanisms, policy lacunae and complacency by government departments and corporate leaders—has sidelined the prevention and mitigation of environmental risks and impacts associated with hydropower development in a context of heightened hazard potential. Huber illustrates how depoliticization of technological risks often works through particular, techno-scientific framings and erasure, i.e., by excluding risk from the terms of the debate.

Central to any analysis of this is the question of how knowledge about risks and vulnerabilities is produced, negotiated and contested. Ulrich Beck and Anthony Giddens argue that the discourse on risk adopted by regulatory authorities is inadequate and offer alternative ways of understanding and positioning risks. Beck [104] (p. 21) defines risk as "a systematic way of dealing with hazards of insecurities induced and introduced by modernization itself". Giddens [60] distinguishes between external risk and manufactured uncertainty, a point developed by Levitas [105] (p. 201): "If risks are perceived as external, only (the) consequences are addressed and if they are considered manufactured the causes will be called into question". For Beck, risks are "manufactured" in the production of scientific and technological knowledge. In his seminal work 'Risk Society', he argues that late modernity has involved a shift from a class society to a risk society—a shift from the questions of the production and distribution of wealth to the production, definition, and distribution of risks. He distinguishes between early modernity in which conflict over wealth (goods) production dominated and later modernity where conflict is focused on the production and mitigation (or not) of hazards ('bads'). Beck's claims (though criticized for being too linear, see, for example, Scott [106]), hold that the central political issue in late modernity concerns the reduction and legitimation of risks, rather than reducing or legitimating inequality. Underlying this there is also a repositioning of the concept of risk. Risks are not 'out there', as external phenomena that need to be deciphered and controlled. They are manufactured, not only through the application of technologies but also through the production and management of knowledge. If risks are manufactured then risk assessment must also address the causes of risks, rather than confining its mandate to assessing risk as a consequence. Second, all interpretations and knowledge of risks, including empirically driven knowledge, are inherently a matter of perception and hence subjective and political. Third, within risk assessment, the politics of risk definition become extremely important, and involve claims about the legitimacy (as opposed to merely the reliability) of particular forms of knowledge. In line with Foucault's 'battle for truth', this revised concept of risk highlights the contested nature of who defines what a risk is, and how. This contestation also calls for a re-examination of the role of expertise, not only in assessing, but also in manufacturing, risks. As Huber [14] explains, political and economic elites are able to capitalize

on risky dam projects, and further marginalize weaker social groups. She argues that influencing the production of knowledge about risk is a fundamental way to challenge the top-down imposition of hydropower and the uneven risks it entails.

Given the importance of understanding and politically discussing such key issues as 'mega-hydraulic risks', 'valid (as well as ignored) dam knowledge and norms', or 'rightful compensations' for affected families, it is fundamental to scrutinize and bring to light the *'commensuration processes'* in norm and knowledge building around dam development projects. It refers to the ways in which experts' (explicit but, especially, implicit) norms, definitions, and values become the equalizing metric: in fact, the politics of how 'cultural particulars' are made universal. In general, the effectiveness and efficiency of large dam developments—including the way in which compensation measures are envisioned and negotiated, directly depend on objectifying and quantifying water resources: as H_2O without any of its cultural values and meanings, on de-personalizing and/or commodifying land, water rights, territories and natural resources, and access thereto within universalistic frameworks and forms of governance. Commensuration is central in that it seeks to standardize entirely different water governance rationalities and hydro-territorial contexts into one, single, common metric (see [107–109]). Hoogendam and Boelens [13], in this volume, elaborate on how the Misicuni Dam and Tunnel project, in Bolivia, was designed to transfer water to the Cochabamba Valley, in particular to the city, and had severe impacts on the rural communities affected by it. Even though the project aimed to compensate those families deprived of their agricultural land, houses and livelihoods, it proved hugely complex to find shared values and expressions of what the losses meant for the different actors involved. The skewed balance of power between the state agencies and indigenous peasant communities biased the terms of commensuration and subsequent compensation that was made.

Commensuration denies circumstantial power relationships, the relevance of water governance contexts, and their embeddedness in particular cultures, territorialities and histories. This also poses a dilemma for NGOs and grassroots movements, which when claiming 'rights', often have to choose how far they can, and wish, to frame their interests as 'commensurables'. This choice is also directly related to how they 'upscale', professionalize, universalize their worldviews and valuations and allow them to be converted into a technological fix (see [23,110–114]).

Espeland and Stevens [107] illustrate this point by using the example of indigenous Yavapai ancestral lands in Arizona, USA, that were threatened by a proposed dam. For the Yavapai (as in numerous cases elsewhere) the land was a 'constitutively incommensurable', intrinsically connected to their ways of life and being and their identification with their ancestral territory. "The Yavapai understood themselves in relation to this specific land. Valuing (the) land as an incommensurable was closely tied to what it means to be Yavapai. The rational decision models used by bureaucrats to evaluate the proposed dam required that the various components of the decision be made commensurate, including the cost and consequences associated with the forced resettlement of the Yavapai community" [107] (p. 327). The modernist commensuration required by the dam project officials involved 'objectively compensating' the affected communities according to 'rational standards' and the 'natural laws of economics' which were incompatible and deeply contradictory to the Yavapai's values, interests and knowledge frames.

6. From Ignoring to Reifying Local and Indigenous Knowledges?

Several papers in this volume discuss the way in which local territorial realities and knowledges are ignored by the big dam regime—the UnGov Legend is very much alive. Bakker and Hendriks [8], in this volume, examine the construction of the Site C Hydroelectric Project on the Peace River in British Columbia, Canada. They elaborate on how, from the outset, the government aimed to bypass regulations that would allow for an in-depth analysis of the socioeconomic, cultural and environmental impacts of the dam. In the process, local indigenous territorial livelihoods and worldviews were largely disregarded, and the treaty rights of indigenous peoples were conveniently overlooked. The article

by Teräväinen [16] in this volume studies divergent and competing expectations about water and technological development through the prism of the Coca Codo Sinclair Hydropower mega-project in Ecuador. During the design and implementation of the project the local peasantry and indigenous people were sidelined and their territorially rooted knowledge regimes ignored. She also elaborates how NGOs draw from techno-scientific approaches and environmental expertise and professionalize political activism in order to gain a political voice, a strategy that may ultimately reinforce the rationality of the techno-economic dam regime. Similar narratives can be found in Dukpa et al. [10,115], Hidalgo-Bastidas and Boelens [12], Huber [14], and Lynch [15], all this volume. Indeed, as Section 3 of this article shows, the dam planning process subjugates local and indigenous knowledges.

Yet, this should not lead us to see Western and indigenous knowledges as dichotomous. As we argue in the next section, 'Western' knowledge is necessarily mediated, hybrid, coproduced. And local and indigenous knowledge is never autarchic, it does not develop in isolation. Dichotomization and reification (and hierarchical 'recognition' of the one by the other) tend to lead to mistaken conclusions and often-dangerous practices, in particular for the marginalized communities themselves. As Cruishank argues, local knowledge " . . . is a concept (that is) often used selectively and in ways that reveal more about histories of Western ideology than about ways of apprehending the world. Its late 20-century incarnation as 'indigenous' or as 'ecological' knowledge continues to present local knowledge as an object for science" [116] (p. 358).

The legacies of primordialism (global), indigenism/*indigenismo* (e.g., Latin America), regenerationism (Spain), recent TEK 'traditional ecological knowledge' approaches (global), neoliberal multiculturalism (global), and similar ideologies, show the profound paradoxes (and complex politics) of modernist 'recognition' of local and indigenous knowledge. At the one hand, day-to-day norms, people's customs and wisdoms, applied to concrete situations, are central in these approaches. They argue that official laws and formally accredited knowledge systems must respect, support and recognize people's legitimate, everyday forms of customs and knowledge systems that have been molded by centuries of practical experience. But, at the other hand, to enforce these local norms and take them beyond solely 'internal use' these approaches commonly set out to systematize and codify them. In order to examine, select and codify customary law and local/indigenous knowledge, and to separate 'good' customs from 'bad' ones, they argue that we need positivist, universalistic science. Experts are then hired to evaluate 'good' local water knowledge and norms. These practices, currently framed as 'best practices', or local forms of 'transparent, good governance' characteristically aim to facilitate 'self-governance under oversight and tutelage' and favor 'compatible knowledges' (see also [111,114,117,118]). The paradox here is clear: while claiming to value customary knowledge and norms they are also considered "to be unsystematic and disorganized, [and] must be submitted to the universalistic rules of professionals, experts, scientists, to select and discipline. Expert intermediaries judge and promote 'universal truthfulness', as if there were one single truth about 'effective' water rights, norms of 'good governance' or 'optimal' agricultural practices" [50] (p. 56).

Ironically, this scientific examination and codification redefines, assimilates and marginalizes local, vernacular, water knowledge frameworks. Only the knowledge and principles that fit into official schemes and policies are approved, thereby muzzling the complex variety of 'unruly rules' and 'disorganized wisdoms'. These modernist recognition approaches ignore the fact that professionals and scientific experts are not disinterested agents but embedded in cultural and power relations. They seek to purify and universalize 'best practices', thereby denying the ability of local water users to actively recreate and regenerate their own water management practices.

At the core, indigenist and TEK approaches, which assume the existence of 'best practices' (that means, 'best knowledge'), implicitly assume that indigenous knowledges are static, non-relational, a-historical, and transferable to other contexts. The only knowledges and practices that are selected are those that are compatible (or can be made commensurate) with dominant modern (scientific, legal, and management) knowledge frameworks. It is not just the 'local actors' who are at risk of being subjugated, but also their modes of knowing and their epistemological worlds: they are " . . . subsumed

within universalizing hierarchies; what is included and what is left out is not random" [116] (p. 371). By making everyday water control, social relations, territories and knowledge forms 'graspable' and 'controllable' such approaches subtly install the dominant culture's knowledge and frames of reference.

In the same vein, Gaventa and Cornwall [119] argue that by reifying local knowledge—by the dominant or the marginalized—and treating it as singular, " . . . the possibility is rarely acknowledged that what is expressed as 'their knowledge' may simply replicate dominant discourses, rather than challenging them" [119] (p. 75). Sandy Marie Anglás Grande adds to this by explaining how " . . . the age-old typification of the 'ecologically noble savage' is being resurrected and employed by certain factions of environmentalists, ecophilosophers, and ecofeminists alike . . . these environmentalists simply add an academic riff to the pop construction . . . as primitive savior, EcoGuru, keeper of mystical wisdom and romantic vision" [120] (p. 312). In the same vein as our observation about the modernist construct of 'equals' through the dehumanizing rationality of mega-hydraulic projects (Section 4), Grande expresses the worry that this essentialization may provide these self-styled 'ecosaviors' with an "oversimplified, and thus, dehumanized identity" [120] (p. 313). Far beyond understanding and supporting the claims of people affected by the loss of their territories and livelihoods, " . . . the noble savage stereotype, often used to promote the environmentalist agenda, is nonetheless immersed in the political and ideological parameters of the modern project" [120] (p. 307).

The idealization of indigenous knowledges can therefore pose a real danger for communities affected by dam projects, or factions within them. For instance, as Paredes Penafiel and Li [121] (p. 16) state: "Writing about the existence of multiple ontologies or worlds risks romanticizing ways of being that do not conform to 'Western' modes of existence, as well as idealizing resistance to extractive industries. People's relationships with nonhuman beings are often translated into the language of the 'sacred' or interpreted as reverence for the natural world, and these ideas are adopted by environmentalist campaigns in ways that distort people's lived realities. This, in turn, essentializes cultural identity and makes differences seem fixed and incommensurable. This is not only theoretically problematic but may also undermine the political goals of those responding to mining activity". Horowitz elaborates on how the discourses that idealize indigenous people's 'natural' ecological rationality and wisdom often stand in sharp contrast to lived realities and may seriously hamper their economic, political interests: "When indigenous people do not attain 'the impossible standards of ecological nobility' set for them, they are judged as inauthentic and their concerns may be ignored [. . .]. Such discourses privilege Western environmentalist values, which can easily be turned into justifications for restrictions on local people's behaviour" [122] (p. 1383). There is a particular danger when activists and environmentalists deny internal divisions and ignore political-hierarchical realities within the communities they are 'defending'—presenting strategic simplifications to governments and donors that portray communities as uniform and united; "[these] simplistic portrayals can play into the hands of corporations who are able to coopt self-styled community representatives and completely overlook less powerful sub-groups, such as women and young people" [122] (p. 1383). In a related vein, Dukpa et al. [10], in this volume, elaborate on how unity among community members in Sikkim, India, beyond a presumed 'indigenous characteristic', was internally forced by community authorities who imposed the *Chya*, (a ritual cursing bringing death by supernatural forces to individuals and their descendants) on those villagers who supported hydropower development against the community's wish.

As we have made clear in the previous sections, we do not aim to deny the importance of the ecological, cultural and technological knowledge frameworks and practices that 'local' and indigenous people possess and deploy, particularly when they are confronted with the rationality of mega-hydraulic interventions and offer an alternative logic of how the territory can support their livelihoods. It is crucially important to understand their voices and the logic of 'other' modes of living. As Grande states, " . . . the reason is not because we possess any kind of magical, mystical power to fix the devastating effects of generations of abuse and neglect, but because we stand as living critiques of the dominant culture" [120] (p. 320). In this respect we need to acknowledge

that local, peasant, and indigenous socioenvironmental knowledge and practices are not exempt from, but are pervaded by power, internal and external divisions and hybridity. Cruishank [116] (p. 358), writing about the Canadian context, says that " . . . local knowledge is not something waiting to be 'discovered' but, rather, is continuously made in situations of human encounter: between coastal and interior neighbors, between colonial visitors and residents, and among contemporary scientists, managers, environmentalists and First Nations". This is not simply an encounter between 'cultural' local/indigenous knowledge forms and 'technical' expert/Western knowledge systems, since " . . . *both* local knowledge and expert/scientific knowledge are cultural, social, and political" [123] (p. 235). Given these dynamic hybrids, " . . . the politics of knowledge production is not simply the challenge to official positivist accounts by local ones—rather it involves conflict within local and official communities themselves, who settle upon definitive accounts in a process of environmental struggle" [123] (p. 235). (Important to note that, in this struggle, responding to racist and modernist regimes, grassroots/indigenous movements also (re-)essentialize. De-constructivist schools often criticize this counter-representation (merely on 'scientific grounds,' applying the same objectivist perspective they claim they challenge) but neglect the political properties in and of these counter-discourses. Grassroots' essentialistic 'counter-images' require critical, contextualized examination as part of concrete struggles, including supralocal alliance strategies and subtle forms of self-representation [4,72]).

In the next section we therefore elaborate upon the relational coproduction of knowledge. Indigenous knowledges are not closed systems neither are 'Western modes of modernity', and, moreover, the latter have no monopoly on modernity. As Eisenstadt [59] (p. 24) argued, "within all societies, new questionings and reinterpretations of different dimensions of modernity are emerging . . . While the common starting point was once the cultural program of modernity as it developed in the West, more recent developments have seen a multiplicity of cultural and social formations going far beyond the very homogenizing aspects of the original version". New, hybrid and alternative epistemological and technological trajectories challenge classical notions of Western (mega-hydraulic) modernity (see also [124]).

7. Sub-Politics, the Dimensions of Power and the (Relational) CoProduction of Knowledge

Complex socio-natural, techno-political constructs, such as large dams, can be viewed in different ways by different interest groups. These entities, and how they are known, are not fixed but sprout (socially and materially) from encounters and interactions between different, often divergent and sometimes incompatible knowledge systems (see [110,125,126]). A large dam can represent a modern feat of technical engineering that controls nature and brings progress. It can also represent the taming and, even death, of a living, animated river that can no longer flow freely, or be a symbol of greedy capitalism destroying ecology and creating inequality; the drowning of a territory that contains and supports human and natural communities; a source of new flora and fauna triggering tourism, or the key to future urbanization, and many other constructs. The mega-dam—as a contested hydrosocial territory—is the focus of conflicting knowledge and value systems and these overarching or hegemonic representations (which may be combined) express the prevailing power relationships at the local, regional, national and international level.

Consequently, the production of dam-related knowledge is an arena [1] or even battlefield, in which the values, understandings and interests of different actors are brought into confrontation with each other. The development of knowledge is a process of hybridizing as Norman Long says. It involves 'multiple social realities', unequal powers, and diverse ways " . . . of construing and ordering the world, [and] not as a simple accumulation of facts or as being unified by some underlying cultural logic, hegemonic order or system of classification. Knowledge emerges out of a complex interplay of social, cognitive, cultural, institutional and situational elements. It is therefore always essentially provisional, partial, and contextual in nature, and people work with a multiplicity of understandings, beliefs and commitments . . . " [1] (p. 15). This relational co-creation of knowledges

also leads to the multiple modernities [59] we have mentioned in Sections 2 and 6. Or as Baud, Boelens and Damonte [127] elaborate in a recent special issue, under a seemingly uniform process of (market and/or state controlled) capitalist expansion, we can witness a multitude of 'capitalisms' and 'developmentalisms' evolving. New hybrid discourses, knowledge regimes and epistemological contestations are being developed, partly forced by public debates and social movements, but also resulting from how large corporate enterprises and the state have learned to adapt their discourses, ideologies and practices (with capitalisms expressing themselves increasingly as 'benevolent', 'green' and 'sustainable', 'pro-poor' or even 'pro-indigenous'). In all instances, even though dominant techno-political engineering knowledge paradigms are hugely powerful in mega-hydraulic projects, knowledge, like power, is a relational process and product, not an asset. Consequently, it cannot be possessed as a property or depleted in a zero-sum game but emerges from interactions between subjects [1,94].

That said, in these political battlefields of knowledge, actors often concentrate upon and reify particular forms of modernist hydraulic/hydrological knowledge: as Long says, as if this knowledge were an absolute property that can be accumulated. "[K]nowledge encounters involve the struggle between actors who aim to enroll others in their 'projects', getting them to accept particular frames of meaning, winning them over to their points of view. If they succeed, then other parties 'delegate' power to them" [128] (p. 27). In these encounters and contestations among 'expert' and 'non-expert' knowledge frames, fundamental political issues are transformed into issues of expertise, debated and fought over.

This mostly occurs outside the realm of the institutional politics of rule-directed struggle. One consequence is that, in the case of large, capital-intensive, public-private interventions, such as mega-hydraulic projects, which are dominated by expert knowledges and financial interests, democratic scrutiny over the planning, design, construction and implementation of mega-hydraulic schemes is very partial. Ulrich Beck [129] referred to such processes as 'sub-politicization': decisions that may affect large numbers of people are debated and settled outside of state-related political institutions and arenas. Here, politics is 'dispersed' or 'displaced'. In his book, *Risk Society*, Beck argues that real politics is made in the various realms of sub-politics such as the firm, the laboratory or the gas station. Collins and Evans [130] raise the fundamental question of whether the political legitimacy of technical decisions in the public domain should be maximized by referring them to the widest democratic processes, or whether such decisions should be based on the best available expert advice. They propose a "normative theory of expertise" that draws the line between appropriate and inappropriate inclusiveness in technical debates conducted in public domains. Sheila Jasanoff [131] responds to this question and argues that such a dilemma is a false one, since we need *both strong democracy and good expertise* for making important public domain decisions, and that the real question is how to integrate them to achieve an appropriate balance between power and knowledge. Wider participation of the lay public, and affected people in expert decision-making is needed in order to test and contextualize the framing of the issues that experts are asked to resolve.

Aside from the question of how dominant mega-hydraulic knowledge subjugates diverse vernacular knowledge (see Section 3), it is also useful to examine the different dimensions of power that influence the production of knowledge and how they are mediated and contested by grassroots and civil society institutions that aim, or claim, to democratize them. Following Lukes [132,133], Gaventa [134], Gaventa and Cornwall [119], Gramsci [135] and Foucault [94,136,137], in the battlefield of 'contested knowledge' the manifestations and modes of power that determine the role of dam-development will vary according to the specific context and situation. While in practice these different conceptual modes and empirical dimensions combine and become hybrids, each power dimension tends to lead to a different approach or strategy of contestation. We examine some of these below:

A first dimension of power relates to knowledge as a 'resource' that is deployed to inform decision-making on mega-hydraulic design and development. Here, power is 'visible' in Weberian

terms and is expressed in vested rules, hierarchies, institutes and institutions. Typically, this expert and formal knowledge is *contested by counter-expertise*. Advocacy groups counter it by presenting 'more objective' and 'better-grounded' (mostly positivist) knowledge that seeks to (de)legitimize the knowledge claims of the dominant stakeholders.

A second dimension and working mechanism of power relates to how knowledge is purposely biased and how power colludes in "keep[ing] some issues and actors from getting to the table" [119] (p. 71): here, we are talking about 'hidden power' [134]. Dominant mega-hydraulic development players, who have control over the production of expert knowledge and may know about particular (e.g., negative) effects of dam schemes, may hide such information in order to promote their schemes. In this way, they aim to skew the agenda, leave out the thorny issues, exaggerate the positive impacts, and include or exclude particular views and knowledge agents. In response, grassroots alliances will engage in the knowledge battlefield by *involving and empowering sidelined actors and alternative issues* when presenting their knowledge and interests in the techno-political debate. Unequal societal structures (e.g., class, gender, ethnic relationships) that produce the knowledge that drives mega-hydraulic projects and excludes grassroots epistemologies and ontologies are actively challenged, bringing the grassroots actors and wisdoms to the knowledge-negotiation table.

Lukes [132] identified a third dimension of power, whereby consciously "winning the hearts and minds" [133] of those subjugated is crucial. Beyond the open or hidden use of power and knowledge, and the generation of conflicts over knowledge, the avoidance of conflict, the subtle silencing of counter-voices and influencing the consciousness of the dam-affected populations are key elements in this. This is done through controlling the production and dissemination of knowledge, the intentional construction of pro-dam narratives and discourses; education and socialization programs and the manipulation and steering of mass media; actively mobilizing ideology in order to shape consciousness, thereby fortifying a Gramscian-style hegemony ([135]; see also [119]). In response to this, grassroots and anti-dam advocates will strive to *curb the process of knowledge production itself*, actively seeking to shape consciousness, and the self-awareness of affected populations and their capacity for knowledge creation and dissemination.

As we outline in Section 3, in the fourth, 'Foulcauldian approach', knowledge and power are not 'possessed' by dominant groups, or strategically deployed to oppress, but are relational and productive forces. Discourses, institutions and practices link knowledge, power and truth in triangular relationships, whereby the normality and morality of large dam projects and acceptance of the mega-hydraulic order are internalized. New, truthful and legitimate knowledge is produced—by both dominant and subjugated actors, who are 'subjectified', and this relational power web steers them towards 'correct behavior and thinking' and even to self-correction. This may lead grassroots and advocacy alliances to engage in the complex task of *questioning the normality of mega-hydraulic development, commensurate modernity, discourses of interconnected national and individual progress and collective harmony*. This is the complex struggle against the boundaries that contain and constrain dam-affected *and* nonaffected societies in a dominant, normalizing, hydro-political discursive network.

Beyond the conflict over the material means of production and the socio-political/hydro-technological re-patterning of humans and non-humans in dam-affected territories, these workings of power also involve a struggle for control over the means of knowledge production, and over who has the societal power to determine what counts as 'normal', legitimate and valid knowledge. In these knowledge battlefields it is not just hydro-political institutions and hydraulic-territorial *objects* and their claims to the truth that are contested, it is also that new hydro-territorial *subjects* are actively shaped, through a process of *co-constitution* (New subjectivities and identities are constructed; human agents and non-human actants are 'subjectified'. In this context the notion of 'subject' simultaneously refers to an actor capable of initiating action and to a being subjected by normalizing power [138,139]). Two articles in this special issue explore this theme. Duarte-Abadía et al. [9] and Hidalgo-Bastidas and Boelens [12] explore the examples of the Rio Grande Dam project in Málaga, Spain, and the Baba Dam project in coastal Ecuador, respectively. They explain

how, in this 'subjectification game', the mega-hydraulic development regime deployed discourses that sought to establish what is 'true' and socio-naturally 'coherent' and how, through these means, they institutionally, materially, and symbolically sought to *shape the mega-hydraulic reality.* In both cases, the networks of dam opponents engaged in fierce knowledge battles through strategic interactions, and 'counter-conducts' that made strategic use of all the four dimensions of power outlined above. They consciously and unconsciously entwined positivist engineering, activist, grassroots and other knowledge systems—with new social relationships and material manifestations as outcomes.

8. Multi-Actor, Multi-Scalar Battlefields

Is it possible that a new and common societal project can democratize mega-hydraulic knowledge building and implementation? And, if so, how? In their contribution to this issue, Fox and Sneddon [11] ask if we can see evidence of new spaces for knowledge production emerging out of contestations over dams that shift epistemological boundaries? Certainly, large dam developments are increasingly contested and subject to alternative proposals from civil society which sometimes lead to their redesign. Examples abound, as in the UK where: " . . . Swansea Corporation announced plans to build a reservoir in the Gwendraeth Fach Valley in Carmarthenshire, flooding parts of the village of Llangyndeyrn. This plan was met with resistance from the population of this area, who built barricades to stop construction workers entering the region [. . .]. This opposition was ultimately successful, with the Swansea Corporation finding an alternative site on unpopulated land and building the Llyn Brianne reservoir near Llandovery" [140] (p. 3). Duarte-Abadía et al. [9], in this volume, describe, how in the Rio Grande sub basin, near Malaga, residents mobilized on a mass scale in a creative network, integrating multiple forms of knowledge, stakeholders and scales to stop the damming of their river, while defending their collective water management practices and creatively constructing an anti-hegemonic alternative for water control. They autonomously constructed a deep-rooted hydrosocial territory that ensured the permanence of their water management legacy whilst, at the same time, renewing their water-cultural practices. Hidalgo-Bastidas and Boelens [12], also in this volume, explain how, in Ecuador's Baba Dam project, indigenous communities, peasant federations, environmental NGOs, critical scholars, water professionals and urban leaders influenced the very structures of knowledge and materials underpinning this mega-hydraulic scheme, and how their socioenvironmental demands helped shape the design of the project.

Sanjeev Khagram opens his earlier mentioned book, *Dams and Development*, by quoting the former president of the International Commission on Large Dams (ICOLD), who argued that " . . . hydropower is the cheapest and cleanest form of energy, but environmentalists don't appreciate that. Certainly large dam projects create local resettlement problems, but this should be a matter of local, not international concern" (cited in [7] (p. 1). It is precisely this local/international interplay that creates, not just disturbances and threats, but also strong movements that challenge the dynamics of the modernist temple of mega-hydraulic progress. Keck and Sikkink [141] argue that such transnational grassroots networks are able to amplify local voices, which in turn provides a platform for those contestations and popular claims that are actively oppressed or fall upon deaf ears at home (see also [111,114,142]). When grassroots networks engage in scalar politics [142–144] they are able to link and pool particular domains and bodies of knowledge from the life histories of affected communities and share them with the internet activist community thereby fostering intellectual diversity and connecting campaigners, human and environmental rights advocates, engaged scholars and students and public officials. Gaventa and Cornwall [119] argue that this endeavor involves both horizontal and vertical networking. Contestation movements that "have gone to scale most effectively have done so horizontally . . . they have included processes of peer-to-peer sharing"—but at the same time, to create new synergies with actors at different scales, "mediating organizations, processes and networks that vertically cut across hierarchies are critical [involving] processes of meaningful representation and voice from one scale to the other." [119] (p. 78. See also [145–150]).

Transnationally allied actors often engage with powerful domestic and international actors who share strategic interests, thereby extending the basis of shared knowledge and action. This extension and hybridization of grassroots knowledge frameworks offers important opportunities for strengthening the influence of local movements, but it also involves dangers. As Dupuits et al. [114] (p. 2) show, "the transnationalization of grassroots movements implies several transformations in the knowledge and languages they mobilize to defend their local common goods. They often have to appropriate and reframe expert knowledge and global norms to gain power and visibility in their mobilizations. This professionalization process is producing distinct effects back to the ground. On the one hand, it can mean more political and financial resources for grassroots movements and an increased recognition by States. On the other hand, it can also imply negative side effects in terms of exclusion of some actors at the margin of transnational processes, or resistance from actors who do not feel well represented". Grassroots transnationalization strategies, therefore, are complex and challenging, since knowledge 'adoption' and 'adaptation' may imply commensuration, institutionalization or normalization [151–158].

But this is not necessarily the case. Water grassroots collectives often react, modify and strategically use the ruling symbolic and political order. "Below [the] appearances of uniformity and formality, local collectives as trans-local networks strategize their ways to resist and construct their own, alternative orders, questioning the self-evidence of formal State, science or market-based frameworks for analyzing and regulating water flows and hydrosocial networks" [72] (p. 246). Here, economic-material and political-symbolic orders and struggles interweave in an effort to defend territories, water rights and livelihoods [10,76,110,121,143–152,159–161]. Following Foucault's remarks, the conceptual/intellectual and political challenge for multi-scalar, multi-actor grassroots networks seeking to defend the commons is to question the dominant epistemology of large dams in order to make space for "an autonomous, non-centralized kind of theoretical production, one whose validity is not dependent on the approval of the established regimes of thought" [94] (p. 81).

The contributions to this special issue present a diverse set of case studies and, at the same time, bring conceptual depth and intellectual rigor to explain these complex issues in their local, regional and global contexts. They highlight the importance of critically examining the (still) dominant regimes of representation that privilege mega-hydraulic projects and the attendant extractivist water policy and scientific regimes that deny the intrinsic complexity, social construction, and political ordering of local water management practices. In discussing the genealogy of dominant knowledge paradigms, the contributors to this special issue propose taking the societal coproduction of water, knowledge and governance as the point of departure, in order to build alternative water epistemologies and ontologies. Or, as Foucault [94] (p. 85) suggested, " . . . in contrast to the various projects which aim to inscribe knowledge in the hierarchical order of power associated with science, a genealogy should be seen as a kind of attempt to emancipate historical knowledge from that subjection, to render them capable of opposition and of struggle against the coercion of a theoretical, unitary, formal and scientific discourse". This implies including other types of knowledge about water control—for instance, that belonging to people who live in the environments that are threatened with being affected by large dams and mega-hydraulic development. This transdisciplinary co-creation of knowledge, which involves both confrontation and mutuality among the water-affected, water-users, activists, the policy and scientific communities—not only critically scrutinizes dominant water knowledge and the workings of neoliberal water culture but also enables the construction of alternative hydro-political knowledge regimes and more just hydro-territorial configurations.

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