



Making a reservoir: Heterogeneous engineering on the Kemi River in Finnish Lapland



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ARTICLE INFO

Article history:

Received 2 February 2014
Received in revised form 1 September 2014
Available online 2 October 2014

Keywords:

Hydropower
Environmental management
Temporality
Water
Lapland
Flood Control

ABSTRACT

This article tells the story of long-lasting and ongoing struggles surrounding the construction plans for a major reservoir on the headwaters of the Kemi River in the Finnish Province of Lapland. A point of contention since the beginning of hydropower development on the river in the mid twentieth century, the reservoir project has been promoted and abandoned multiple times in waves of land purchasing, legal procedures, opposition campaigns, and the delineation of nature reserves. Despite a Finnish Supreme Administrative Court ruling officially setting an end to the project, it never entirely left public discourse and is currently being re-negotiated in slightly adapted form. Articulating voices and documenting practices of riverbank inhabitants, activists and hydro electricity managers, this article presents the struggle as multiple modes of heterogeneous engineering, where both proponents and opponents work towards creating different realities. The article develops the metaphor of heterogeneous engineering by drawing attention to three temporal dimensions central to the reservoir struggle: moments, which refer to the situated emergence of practices and strategies; futures, which speak to the attempts to build and contest expectations regarding conflicting projects; and durations, which consider the cumulative aspects of a decades-long struggle on people and landscapes. Thereby, the article contributes to discussions on making, planning and environmental management, and illustrates ways of studying these processes as situated practices in relation to time.

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Introduction

As I climb up the steps to the wooden bird-watching tower, the sun is about to set. After a day of driving and walking through the forests and bogs of Eastern Lapland, this is the first time I get an overview perspective of the landscape; the topography is so flat that it hardly affords a view. My two companions and I look around: there is a large open bog with a small lake on its edge on one side, the setting sun reflecting off every bit of water. The forest stretches out on the other side, pierced by the forestry road by which we came. My companions express their mixed feelings about this landscape: on the one hand, they cherish the bogs and forests for their beauty, quiet, and the berries they pick there every year, they treasure their childhood memories of particular places and joyfully recount the stories of their involvement in boating demonstrations on the nearby Kemi River or the construction of this tower and the shelter building next to it. On the other hand,

they are saddened by the social and economic decline in the area, visible to them in the “unmanaged” state of the forests, the number of derelict buildings, and the conflict in the community. During the day, they had introduced me to a number of people and places in the area, most of whom and which I would revisit during the following months. My companions had selected these places and people to present to me the landscape that had for decades been at risk of being transformed into a giant hydropower reservoir, as well as some of the people who had been opposing this project. Standing on the bird-watching tower, they are proud that the surroundings have not been drowned, and that a few years ago a Supreme Court ruling against the reservoir has been passed, which gave them the confidence that these surroundings would not be drowned in the future either.

A few months later, I find myself in a large, windowless room with a long, crescent-shaped desk, lined with computer screens. Rather than the activists who showed me the bird-watching tower, my companions here are an engineer, a mathematician and a technician, explaining the intricate technology by which their company is able to control, from this very room, the electricity production at virtually all the hydropower stations in the Kemi River

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catchment. This is complex business indeed, as the production at any one dam will influence water levels both upstream and downstream, potentially jeopardising hydropower capacity for peak demand, or annoy fish, fishers and riverside residents. It is especially tricky now, during the spring, when the river is flooding with the snowmelt that swells its discharge up to twenty-fold compared to the winter-time amount. Luckily, the company has a few larger reservoirs that it can use to buffer the flood peaks. But that is hardly enough to deal with the massive floods, particularly because the un-checked headwaters of the main course can produce a huge increase of discharge with major implications for downstream technology and population. Of course, there have been plans to take care of this problem, and my companions point me to a large colour picture on the wall opposite the computer screens. It is an artist's impression of an aerial view of a landscape in Eastern Lapland on the upper Kemi River. The scene is dominated by a large, dark blue lake, dotted with shallow wooded islands and bordered by hills in the background. This reservoir, my companions explain, would have been the solution for many of the current challenges of hydropower in Lapland: not only would the spring season be much less risky for infrastructure and residents, but also would the company be able to use the river much more efficiently over the course of the year, releasing some of the water from the reservoir during dryer periods to increase electricity production. Unfortunately, though, the planning process for this reservoir has been stopped by a Supreme Court ruling a few years ago, so that the hydropower infrastructure remains incomplete.

Performances and promises

Nature and landscape, engineering and planning, are not stable entities or fixed procedures, but have been recognised as continually made and improvised in what have been called “performances” (e.g. Suchman, 2000; Szerszynski et al., 2003; Latham and Conradson, 2003; Hastrup, 2007; Abram and Lien, 2011). People bring landscapes and planning processes into being through their practices, in concert – and often in conflict – with other people as well as with non-human beings and dynamics. What Tim Ingold has called the “taskscape” (1993) and the “weather-world” (2008) are expressions of these emergent relational forms, always negotiated within fields of simultaneously social and ecological processes. Understanding people's engagement with their total environments as situated practice in this way implies that planning and management – i.e. conscious attempts to alter these environments – are equally enmeshed with the planners', managers' and other relevant people's activities and experiences in the world. Ingold has described this as an interplay of finding and following ongoing flows and developments and of “bending them to their evolving purpose” (2010: 92). This means that environmental management does not act upon a fixed, external domain (“the environment”), but constitutes an interactive grappling with particular flows and frictions of the world, of which its practitioners and their changing intentions are themselves part. Counter to a Western tradition of thought which assumes that architecture, engineering and related disciplines comprise projects that can be thought out in all their details before they are embarked upon and negotiated with the currents of life, actual processes of making – including in practice those of architecture, engineering, etc. – are more like “weaving” than executing: they always emerge from an interplay of the practitioner, the materials, and the developments that they undergo in the process (cf. Suchman, 2007). For example, a former employee of the U.S. Army Corps of Engineers, an agency known for its decisive role in dam building in the USA and beyond, calls engineering an “art” that does “not correspond with high-modernist ideology” of technocratic, rationalist planning

and implementation (Reiss, 2008: 546). Rather, “engineers often spend more time negotiating than building” (Reiss, 2008: 531), so that “we must pay more attention to a negotiating process that does not always end in a project, but nevertheless is an intrinsic part of engineering activity” (Reiss, 2008: 546). Building, making and engineering are thus part of human involvement in the world, rather than an execution of ideas made up insulated from this world and realised through the manipulation of an exterior material environment. Only when treated as an abstraction, such as “the global environment”, does the environment become an external “world apart from life” (Ingold, 2000: 210) rather than the life-world in which people dwell and plan and with which they engage in projects of environmental management.

This article scrutinises the performance of a hydropower reservoir project in the Finnish province of Lapland. The empirical material derives from a year of ethnographic fieldwork in 2007 and 2008, as well as follow up visits and conversations with activists and hydropower company personnel in 2013. Fieldwork included meeting, talking, and visiting the river or other significant places, including wetlands and hydropower infrastructure, with people whose lives and work were related to the Kemi River. Here, I draw mostly from notes I took during and after interviews or other meetings with people who have been involved in this particular hydropower project. People spoke about the reservoir conflict both retrospectively, concerning the way it had affected their lives and the river, and proactively, concerning its possible futures and the respective futures of river and riverbank inhabitants. During the time of the fieldwork, the project was especially present in public discourse and the media, as it was in the process of being – once again – re-defined and re-introduced by its proponents. At times, the reservoir seemed to epitomise the fate of the entire catchment, which was either to be entirely ‘harnessed’ (should the project be implemented), or on the cusp of an era of ‘ecological’ appreciation and restoration (should it be abandoned). Focusing on the changing activities in which reservoir proponents and opponents have been engaging over the course of the struggle, I demonstrate how negotiating the project is materially and culturally situated and emergent, enmeshed in and drawing on a variety of heterogeneous processes.

Throughout the article, I focus on three aspects of time that I found central to the unfolding of the reservoir conflict, namely moments, futures, and durations. These three dimensions derive from my attempts to make sense of what different people told and showed me about the project. They seemed apposite for capturing the combined phenomena of a project that (1) was periodically shifting in image and terms of debate, (2) was fiercely debated in terms of the futures it would embody, and (3) had never been built but nevertheless had striking effects in the present due to its sheer longevity. First I note that specific *moments* are crucial in the development of the struggle, as the various and changing practices of reservoir proponents and opponents continually emerge out of particular situations. At the outset of the conflict, it would have been impossible to predict what form these practices would take. Only in the process of performing activities and strategies, situated within ever-changing sets of relationships, do they assume reality. This understanding has been explored, for instance, in the emergence of scientific knowledge (Pickering, 1995; Pickering and Guzik, 2008) that is not only a function of researcher and apparatus, but critically also of the always unique moments of their engagement. A focus on emergent moments is similarly evident in what Karen Barad (2003) calls “posthumanist performativity” to address the continually emergent issues and struggles in human engagement with the material world. For environmental management scenarios like the reservoir project, this means that human planners, practitioners and opponents necessarily act within an emergent world that not only may resist or follow

unanticipated trajectories, but also actively participates in the processes of meaning-making and the negotiation of futures.

The second crucial aspect of time in the practices of heterogeneous engineering concerns their all-pervading relations with possible, but unknowable *futures* that are imagined, desired or avoided, negotiated and enabled in the present. These relationships have received some attention in geographical writing about performativity (e.g. Latham and Conradson, 2003; Thrift, 2003), as well as in sociological exploration of the future (Mische, 2009; Adam, 2010). In a similar vein, Simone Abram and Gisa Weszkalnys (2013) have recently argued that contemporary planning processes should be understood as an assemblage centred on “elusive promises”. They highlight the role of the temporalities of planning and note that “[t]he future promised in plans seems always slightly out of reach, the ideal outcome always slightly elusive, and the plan retrospectively always flawed” (2013: 3). Promising itself is performative and needs to be associated with “appropriate procedures, objects and circumstances” (Abram and Weszkalnys, 2013: 10) to become effective. Furthermore, the very idea that plans and planners can formulate specific promises, rather than vague intentions, presupposes a profoundly modernist understanding of materiality, human agency and reason, instigating that materials and institutions are external realities that can be modified by humans according to rationalised procedures.

Recent work on the management of expectations towards technological innovations (e.g. Borup et al., 2006) has emphasised the importance of “promissory organizations” (Pollock and Williams, 2010) for creating and maintaining visions and expectations of future developments that have tangible effects in the present, including funding opportunities and research foci. On the one hand, “expectations can be seen as fundamentally ‘generative’, they guide activities, provide structure and legitimation, attract interest and foster investment” (Borup et al., 2006: 285–286) and thus affect people’s present lives independent of their coming true or not. For example, fostering the promise of near-future innovations in the stem-cell sector has convinced growing numbers of families to buy the services of so-called ‘blood banks’ which store blood from a newborn’s umbilical cord in order to possibly treat eventual illnesses later with a therapy that is promised to be on the verge of discovery (Brown and Kraft, 2006). On the other hand, these expectations need to be carefully managed in order to create those effects, for example by ostensible consultants and analysts, who try to make sure not only that previously disappointed expectations do not discredit the promise’s author, but also that current expectations are taken up by relevant actors who work towards them becoming ‘self-fulfilling prophecies’ (Pollock and Williams, 2010).

The final dimension of time that I found decisive in the reservoir struggle concerns *duration*. The conflict has lasted for decades, and developed its own dynamics in the process. Most notably, the long-lasting insecurity about the fate of the area – would it be transformed into a reservoir or were other development paths feasible at all? – left its marks on the local communities and landscapes. Currently already in the second generation, the activists are getting tired and frustrated with the way their victories are being eroded by seemingly never-ending waves of renewed campaigning for the reservoir. This dimension of time has been highlighted by Barbara Adam (e.g. 1995) who insists on the importance of considering human bodily temporalities, for instance of activity and rest, or of growth and ageing, alongside more abstract kinds of time, including that of the clock and the calendar. For understanding the reservoir conflict, this implies an attention to its duration as an irreversible process, in which human lives are lived and exhausted, communities thrive, dwindle or split, and forests grow into timber or brush.

Heterogeneous reservoir engineering

I propose that the various performances that keep reshaping the reservoir conflict can be grasped as attempts at “heterogeneous engineering,” a concept that can itself be enriched by elaborating its relations with the temporal aspects sketched above. The term has been coined by John Law (1987), and put to interesting use in Lucy Suchman’s writings. Suchman (2000, 2001) has described the construction of a US American bridge as arranging “more and less effectively stabilised material and social relations” (2000: 316). She elaborated: “A county supervisor campaigning on the issue of public transportation, a militant group of hikers and cyclists, a new endangered species listed, a new clean air act can each send the [...] planners back to the drawing board of redesign and renegotiation.” (Suchman, 2000: 316) Because bridge building is thus as much about aligning changing public opinions as it is about arranging earth, steel and concrete, Suchman referred to the metaphor of heterogeneous engineering, which Law (1987) developed as an alternative explanation for the Portuguese maritime expansion of the 15th and 16th centuries. According to Law, this remarkable success was achieved through a combination of ingenious as well as serendipitous moves, including the development of particular sailing ships, the adaptation of scientific equipment for navigation, the exploitation of certain winds and currents, and the lack of an organised navy protecting Muslim traders on the Indian Ocean. Heterogeneous engineering thus refers to building artefacts or systems out of qualitatively disparate ingredients, including wood, ocean currents, royal decrees and spices. I found “heterogeneous engineering” a particularly apt metaphor for illustrating the conflicting practices and strategies of reservoir proponents and opponents, as it not only refers to the practice of engineering (itself a core field of hydropower development), but also explicitly accounts for the different and serendipitous elements and moves that are combined in what is also called “complex socio-technical assemblages” (Suchman, 2012: 48) for pursuing a project.

Since its introduction by Law, the concept has been criticised, alongside similar metaphors from early actor-network theory, on a number of accounts, especially its focus on an allegedly all-powerful “engineer” who manages to arrange the world according to his [sic] ends (Star, 1991; Law, 2009). For instance, it has been argued that creating enduring systems requires, rather than centralised engineering, cooperation between different actors, which in spite of their differences can be achieved through so-called “boundary objects” that mean sufficiently similar, if otherwise divergent, things to relevant participants (Star and Griesemer, 1989). Notably, Law himself has since changed his analytical vocabulary and used the concept of “ordering practices” (1994) to point to the always ongoing, but never complete, uniform or singular attempts to organise relationships in order to further particular goals, such as the functioning of a laboratory. Taking these criticisms and developments into account, I concur with Suchman (2012) that the metaphor of heterogeneous engineering remains useful for pointing towards various material practices in pursuit of specific, if different and changing, goals. Understood as multiple ordering practices, I use the term to denote attempts either to create and stabilise conditions for building the reservoir, in the case of the developers, or for permanently avoiding it, in the case of the opponents. Thereby, I treat both developers and opponents as “engineers” and illustrate that heterogeneous hydroengineering comprises manifold practices that not only concern the project area directly, but also affect the wider sets of relationships in which the project comes into being. In this sense, such engineering work is similar to what Tironi and Farías (2015) call “immunising life”, practices that create and maintain life-sustaining assemblages for particular groups of people.

Furthermore, I find the “heterogeneous engineering” trope useful as it chimes well with an approach to environmental management as situated practice and with the three temporal dimensions outlined above. Regarding “moments”, the focus is on the engineering, as an emergent and ongoing activity that is situated both regarding a certain goal and in a field of social and ecological relations. Considering “futures”, the heterogeneity of the engineering is central, as not only building materials are heterogeneous, but also their products, including expectations as much as reinforced concrete. Further on in the text, I illustrate how these engineering practices work towards establishing the material-semiotic conditions that make the realisation of the actual project necessary or impossible. For “duration”, the term points to the sense of longevity associated with engineering projects, as opposed to simply calling them “practices” which may have a much more ephemeral ring. Finally, “heterogeneous engineering” is helpful in keeping the human grounding of hydropower projects central: these performances do unfold in a more-than-human field of relationships, but the motivations for it are different human interests.

Approaching a reservoir project through the trope of heterogeneous engineering places the article also in a growing tradition of science and technology studies about water (e.g. Barnes and Alatout, 2012). Indeed, many of the project’s performances emphasise the technical aspects of hydroelectricity. In Finland, electricity demand regularly outstrips supply, especially during the cold and dark winter. Many Finns regard the resulting dependence on electricity imports from neighbouring countries as precarious. Whereas hydropower does not provide the bulk of electricity in the country, this source is critical as so-called “regulation energy” that adjusts the supply to a constantly fluctuating electricity demand. One of the main issues of hydroelectricity generation on the Kemi is that electricity consumption and river discharge follow conflicting patterns that the hydropower company attempts to negotiate with their powerful machinery of dams, reservoirs, etc. Electricity consumption is highest during winter, but this is also the period when river discharge is lowest, as most of the watercourse is frozen over and precipitation falls as snow, which does not enter the river. Discharge is highest during snowmelt and concurrent spring floods, but it is so much higher that much of it needs to be spilled through flood gates as it by far exceeds the turbine capacities. Reservoirs are intended to retain some of the spring flood runoff, in order to gradually release it in winter (cf. Krause, 2011a, 2013b).

The specific characteristics and potentialities of water are thus decisive dimensions in the reservoir struggle. A substance that can readily be stored and employed for electricity production, but that is also volatile and – when dammed – submerges a wide area in the relatively flat terrain of eastern Lapland is, in Bakker’s terms, “inherently political, not only because it is an object of conventional politics, but also because of its material imbrications in the socio-technical formations through which political processes unfold” (2012: 618). According to Bakker, these formations are also implicated in biopolitics, as water is not only socio-technical, but also “socio-natural” (Bakker, 2012: 619). Similarly, Linton and Budds (2014) used the “socio-natural” label to describe their “relational-dialectical approach to water” that culminates in a “hydrosocial cycle”. This concept is useful in redefining human practices and structures not as external to the movement of water, but as crucial constituents of water circulation and non-circulation. Conversely, Bijker (2012) has suggested that not only are humans implicated in the constitution of water circulation, but also water is so central to social relations that it might be apposite to approach human life as “water cultures”.

Research on flood risk predictions and management (e.g. Lane, 2014), a “water culture” if ever there was one, has drawn attention to the mutual implications of scientific knowledge about floods,

political priorities of flood risk management, and changing landscapes in an essentially “socio-hydrological” world. What and how hydrologists study and predict is directly linked to the wider field of relationships, simultaneously social and hydrological, which both influences and is impacted by their studies and predictions. While this work resonates with the temporal aspect of “moments” in heterogeneous engineering, it also speaks to the “futures” aspect. For instance, Lane and colleagues have argued that predictions about flood futures are made through a particular “suite of practices” that has been “designed to constrain what the future is allowed to look like” (2011: 1786). These futures, in turn, produce particular kinds of interventions aimed at making the world conform to their predictions.

That this is often a futile goal has been evidenced by uncounted hydroengineering projects worldwide. A striking example is the gigantic Ma Pong dam project on the Mekong River, which was driven by the US Bureau of Reclamation in a mission to foster American sympathies in mainland Southeast Asia during the 1960s (Sneddon, 2012). Based on geopolitical objectives, a vast amount of hydrological and related data was created for about a decade, at a cost of roughly ten million US dollars. The immense challenges that the project would imply were silenced, until US geopolitics shifted to other priorities and the project was discontinued in 1973. Nevertheless, the work on the project had direct consequences for the geographical and developmental imagination of the region, for instance by establishing the Mekong basin as a unit of analysis and intervention. This, again, points to the “duration” aspect in heterogeneous engineering, where intense engineering processes – whether successful or not – leave their marks on the landscape and people’s biographies.

In sum, I propose heterogeneous engineering as a useful metaphor for approaching the particular performances that make and unmake projects. I suggest the term can be productively integrated with the three temporal dimensions identified. It is open to holistic analysis of more-than-human relations without a need to refer to clumsy hyphenated constructions like “socio-technical” or “socio-natural”. If employed as outlined above, it can draw attention to the situated practices that constitute ventures of environmental management more generally as much as the particular reservoir project to which I will now turn.

A short history of a never-ending project

The reservoir project, which has gained notorious fame under the label of Vuotos, has been planned, discussed, redrafted, rejected and re-planned numerous times for more than 50 years (Autti, 1999; Suopajärvi, 2001). Taking its name from a minor tributary to the upper Kemi River, Vuotos would be the third reservoir on the headwaters of the Kemi, increasing hydroelectricity generation on the river by 10%, mostly through improved capacities for regulating the river’s flow over the course of the year. The performance of this project has been everything but smooth, and certainly not according to any consistent script. Rather, the project has undergone radical adjustments and redefinitions in the course of its existence, and even though it has never been successful enough to actually be built, it is flexible and resilient enough to keep lingering – in some form or another – in public discourse and the landscape of eastern Lapland.

The then state-owned hydropower company Kemijoki OY, established in 1954 to develop hydroelectricity production in the Kemi River catchment (Myllyntaus, 1991: 108–115), published the first master plan of what was to become the Vuotos project in 1974 under the label of the Kemihaara Reservoir, referring to the upper Kemi River. Until this point, publishing a hydropower plan in Lapland had been a self-fulfilling prophecy, part of

performances that necessarily led to the realisation of the project. Riverbank inhabitants, however, had started to associate negative environmental and social impacts with hydropower reservoir projects: Lake Kemi, the largest lake in the catchment, had been turned into a reservoir until 1965, and on the headwaters of two major tributaries, the Lokka and Porttipahta reservoirs had been finished in 1967 and 1971 respectively (Asp and Järviöskö, 1974; Järviöskö, 1979; Asp et al., 1981; Suopajärvi, 2001). Alongside repercussions for ecology and livelihoods, these projects caused social grief in particular through the displacement of a number of villages and hamlets from the prospective reservoirs (Luostarinen, 1982; Huttunen et al., 1995). Therefore, opposition to the new reservoir was forming in the second half of the 1970s, driven both by inhabitants of the project area and Finland-wide environmental groups. The practices of this protest included so-called “fur hat delegations” (*karvalakkilähetystöt*) where upset river dwellers visited the capital Helsinki wearing their typical winter gear to voice their worries and claims concerning hydropower developments on the Kemi. These performances of aggrieved Laplanders contributed to the social-democrat government deciding, in 1982, to prohibit the reservoir and instead allocate funding for alternative pathways of economic development in the region.

Soon after this decision was made, however, many commentators started to perform it as an environmentalist luxury at odds with the slow economic development in the region and wider economic anxieties in Finland, so that public discourse quickly took up the project again. As Timo Peuhkuri put it: “During the 80’s, the project turned from being merely an energy policy issue into a national conflict symbolising the struggle between economic values and environmental values” (1996: 81). In 1987, the hydropower company adjusted their respective ordering practices and published a revised master plan, now under the label of Vuotos Reservoir, and in 1989 initiated a wave of renewed land buying in the projected reservoir area. The new, conservative government then officially revoked their predecessor’s decision against the reservoir construction and, in 1992, allowed the hydropower company to apply for a licence to build Vuotos.

This ensued in the protracted performance of a licensing procedure that lasted from 1996 until 2000, when the Water Court of Northern Finland – the judicative organ responsible for water management projects in this part of the country at the time – approved the project based mostly on a favourable cost–benefit analysis of the reservoir. When the opponents appealed this decision, the Administrative Court of Vaasa overturned the Water Court’s ruling and rejected the project. In its statement the Court explained: “Society and its values have significantly changed [...]. The societal and legal relevance of environmental and nature protection values has increased nationally as well as internationally in the recent decades” (cited in Koivurova, 2004: 55). This was the first time in Finnish history that a hydropower project had been rejected on environmental grounds. When the case was moved to the Finnish Supreme Administrative Court in a second round of appeals, the judges upheld the decision against the reservoir in 2002, but based their reasoning not on changed societal values, arguing instead that a 1987 amendment to the Water Act stipulated the rejection (Koivurova, 2004).

By this time, people were debating the reservoir so heatedly in regional, national and international fora that the Supreme Court ruling did not bring closure to the issue. Both proponents and opponents of the reservoir continued their ordering practices to further their objectives. On the one hand, leading politicians were quoted as publicly announcing that the Court’s decision was mistaken or flawed. On the other hand, reservoir opponents performed the ecological value of parts of the area that was to be drowned by the reservoir to advance their designation as Special Protection

Areas for the EU-wide *Natura 2000* network in 2005. This designation had been pending since the late 1990s, but stalled – as reservoir opponents argue – by government officials sympathetic to the reservoir project. Reservoir opponents felt safer with EU protection complementing the national Supreme Administrative Court ruling.

During the same year, however, the spring flood in the Kemi River catchment caused some damages and disruptions, which the reservoir proponents remade into a new set of arguments for the project. In 2008, the Council of Lapland, a consortium of representatives from the province’s municipal governments interested in promoting and coordinating economic development, presented a “flood control” scheme, the centre piece of which was essentially the same Vuotos reservoir that had been rejected by the Supreme Administrative Court only six years earlier. In a public presentation of the scheme, Council representatives keenly emphasised that the present project was fundamentally different from the rejected one, as it concerned a common, societal good: flood protection. The Council also carefully avoided the now highly charged label Vuotos, instead calling their project Kemihaara Reservoir again (Krause, 2013a). While this move shifted the justification of the project onto new terrain, the reservoir opponents were not idle either, launching in the same year a campaign to create a “Vuotos National Park” overlapping with the area of the debated reservoir. According to the campaigners, this park would not only provide alternative income – in the form of tourism and the sale of local products – to the inhabitants of the economically deprived area, but also form yet another layer of protection, and thus certainty, against further resurrections of the reservoir project.

Also the hydropower company did not passively stand by, but increasingly performed hydroelectricity as environmentally benign and sustainable, for instance in their public relations materials that emphasised the renewability and carbon-free production of hydroelectricity. It published a booklet entitled “Overwhelming Waterpower” (Kemijoki OY, 2008), and re-launched a public relations journal distributed freely in the catchment, which had been discontinued after the unsuccessful licensing procedure for the original Vuotos. Alongside the positive environmental effects of hydropower, these publications emphasise the “multiple use” of reservoirs, most evidently with fishing, but also other recreational activities. The reservoir was thus re-framed as environmentally and socially beneficial within the current set of values. A glance at the present web pages of the hydropower company equally reveals their active role in rallying support for the reservoir. One section, for example, speaks of the “many uses” of water storage, including the societal and energy-economic need for “regulation power” to adjust electricity supply to the fluctuations of demand. It adds that a new project is underway to design a reservoir “in the area of the old Vuotos project”, but which is “unlike Vuotos in name and realisation” (Kemijoki OY, nd-a). The website also promises that “there are no insurmountable obstacles to building” (Kemijoki OY, nd-b), for instance concerning the fact that the area in question belongs to the *Natura 2000* network. It assures the reader that the government can always change such regulations in the name of energy and climate politics. Furthermore, during the 2013 spring flood, the company released a report on its website, which deplored the waste of energy and money that came with the lack of reservoir capacity in the catchment (Kemijoki OY, 2013a). It stated that in the past year, water that could have produced 42 million Euros worth of electricity has been spilled through flood gates on Finnish dams. On the Kemi alone, floodgates need to be opened and water released past the turbines unused for 30–50 days a year. A flood defence reservoir on the upper Kemi River, the report said later, would abate this “loss of energy” and produce 300–400 GW h more per year. According to the company’s algorithm, this would cover the electricity needs of up to 80,000 households, a phenomenal number in sparsely populated Lapland.

Momentary management

The preceding historical sketch has shown how changeable the argumentation for or against, the performances and the official status of the reservoir project have been over the previous fifty years. As situated practices, the heterogeneous engineering efforts have all come about in particular moments that made them feasible in that point in time, but untenable when that particular field of relations had waned. The current section will explore some of these moments in more detail.

One particularly decisive moment was the licensing procedure during the 1990s, with the staging of assessments at a time when the Finnish government was in the process of drafting a law standardising environmental impact assessments. Conducting such studies performed a progressive openness to revealing also the negative aspects of the project, and the willingness to address and compensate them. [Peuhkuri \(1996\)](#), however, has argued that the negative reception of the project was due to the particular design of the assessment procedure that failed to include reservoir critics in the drafting stage. He located the reason for the project's inability to bring the opposition onboard in an "unsuccessful problem formulation" ([Peuhkuri, 1996: 90](#)), which defined the reservoir too narrowly as a national project of energy production and omitted a clear definition of real development alternatives. The inferior quality of the official assessment, according to [Peuhkuri](#), prompted the opposition to find alternative outlets for their concerns, for instance national and international media. He cautioned that as long as an assessment is presented as a technical issue with no space for wider value discussions, potential opponents are alienated from the negotiation process and the proposed project alike (cf. [Karjalainen and Järviskoski, 2010](#), on impact assessments in a neighbouring hydropower conflict). Following [Suchman \(2000\)](#), the impact assessment can be considered as part of heterogeneous engineering, as a social practice involved in stabilising, or destabilising, the envisioned construction project. Here, the assessment emerges as an unsuccessful attempt to promote the construction of the reservoir, for its failure to engage and persuade the project's critics. Indeed, as studies of public engagement in technological development issues have indicated, developers frequently treat participatory assessments as cumbersome obstacles necessary for legitimization, which have little effect on the proposed technology, and critical analysts point out that inclusive decision-making aimed at public consensus is neither possible nor attractive ([Wynne, 2003; Irwin, 2006](#)). While we can thus concur with [Peuhkuri \(1996\)](#) that the impact assessment for the Vuotos reservoir failed in consensus-building, we must be cautious regarding his hope of more inclusive appraisal methods. In spite of ongoing attempts to improve participatory decision-making, impact assessments are necessarily technical exercises to advance a project with agendas set by the developers, rather than value-based discussions about radically different alternatives.

Just how different the terms of reference of proponents and opponents have been during that time becomes obvious when reviewing the information brochures that the hydropower company and the opposition movement distributed during the Water Court proceedings. While the hydropower company's brochure consisted of long lists of numbers and graphs, the opposition movement's brochure was rich in pictures of local animals, plants and landscapes; it reproduced poems and quotes from local residents, and visually compared the extent of the planned reservoir to the city of Helsinki indicating the large size of the former. The opponents performed issues of scale also beyond these visual representations: they managed to circumvent the developer's framing of the project as a national issue, by enrolling Sweden and the EU. One of the main arguments against the reservoir in the court cases

during the licensing procedure included Swedish concerns about water quality in the Gulf of Bothnia, as well as tensions with the EU Commission regarding the designation of Special Protection Areas in the project area ([Koivurova, 2004](#)). The nature conservation that Finnish and Swedish environmentalists and EU commissioners on the one hand, and local activists on the other were propagating was probably quite different in principle – focused on bird habitat or scenic beauty for some of the powerful partners, and on people's homes and traditions for the local movement ([Autti, 1999](#)); but the activists' strategic alliance proved successful nevertheless. Realising that in the terms defined by the hydro-power developers, their cause was likely to be deemed insignificant, the activists managed to change the terms by introducing alternative ways of representing what is at stake and by enrolling international political discourses and institutions. Also the idea of the local, and the value of protecting a particular place and ecosystem, received more resonance in an international forum, compared to the national discourse that framed the Kemi River as a source of electricity.

Alongside these largely representational aspects, heterogeneous hydroengineering has also taken more directly material forms. Reservoir opponents have, for instance, installed a number of signs and billboards along the roads in the project area, indicating how high the water would be in particular places. In one of them, the water that dominates the lower part of the sign is brown, a statement about the water quality issues many residents are concerned about. Not a clean and blue fishing paradise is planned here, the sign seems to say, but a dirty and polluting machinery. Alongside the signs, the reservoir opponents have physically engineered their vision of an undammed river landscape also through building bird-watching towers, shelters, and other buildings within the planned reservoir area. Together with the "Vuotos National Park" initiative, these buildings signal to other residents as well as the wider Finnish public that the area is well worth visiting and may attract more "nature-based" tourism ([Krause, 2011b: 39–42](#)). Bird-watching towers and signs, however, are not just signals, but simultaneously physical manifestations in the landscape; and building, maintaining and using them is part of the performance of a reservoir-free area.

Much talk about nature-based tourism clearly belongs to the elusive promises discussed in the next section, but some tourism-relevant initiatives do exist in the area. A small group of local entrepreneurs, for instance, have started organising annual river tours in July, which they call "Nightless Night Rowing Trip" (*Yöttömän yön soutu*), where participants row down the Kemi River in boats modelled on traditional vessels that were used by villagers to travel to church in the past. Participants are fed local food and housed in local cabins and hotels. Locally produced food, along with local tradition and livelihoods, are thus performed as a counter-project to the reservoir. Local food is also a concern in the area more widely, as some people feel uncomfortably dependent on food imported into a region that was mostly self-sufficient in terms of food half a century earlier. The municipality of Kemijärvi, for instance, is working on a local food project that is to encourage people to produce and locally market more food, including from small-scale agriculture, dairy production, fishing, reindeer herding, berry-picking and hunting. These activities, of course, require an environment not covered in polluted reservoir water, but one of rivers, berry bogs, reindeer pastures and forests. Even where these activities are not directly conflicting with the reservoir project, people name them in the spirit of alternative development visions for the area: locally produced, small-scale products and services as opposed to a large-scale reservoir for national (read "Southern") electricity generation. These initiatives can again be seen in the light of their moments: performing the

area as local and traditional in a particular period when such attributes are considered as virtues, rather than as signs of backwardness in need of modernist development.

Realising that, as a relatively small group of people in a relatively peripheral part of the country, the opposition movement would not be able to muster enough momentum to counter the powerful hydropower industry, they furthermore founded a small company, the shares of which were sold to more than 500 people and organisations across Finland and abroad. With the funds of the company – aptly called Vuotos Power Ltd. – and a large voluntary input from activists, a cottage and a sauna were built on a Vuotos River tributary in the reservoir project area, again to raise awareness and encourage use of the area for purposes other than hydropower. As a common asset of the company, the cabin can be used by all shareholders. In another strategic move, a couple of local farmers donated a few hectares of land in key spots to the Finnish Association for Nature Conservation, and sold very small parcels of land around those to more than six hundred private persons and organisations from all over Finland and beyond. Through these initiatives, they made all these people and organisations legally relevant stakeholders in the reservoir struggle, a much larger group than the original few landowners, most of whom were continuing to sell their land to the hydropower company for apparent lack of alternatives. The activists thus managed to increase the number of persons critical to a reservoir who would have to be involved in any future court case.

Central to these various “engineering” practices is their “timely” character: all of them emerged at specific points in time, reflecting the respective actors’ attempts to seize a current opportunity or to engineer an opportune moment. A crucial temporal dimension of these performances is thus the moment that they participate in constituting. The coincidence of the project with large-scale social changes in Lapland, the formalisation of environmental impact assessments in Finland, the country joining the EU, the waxing and waning of environmentalism, and the international vogue for local food and ecotourism names just a few out of the many facets that actors drew on in shaping the conflict. While it is possible to construct this narrative in hindsight, it would have been impossible to foresee even a fraction of these facets at the outset.

Engineering conflicting futures

Even though the construction of the reservoir project’s dams and canals has not even begun, the landscape has been thoroughly transformed, for instance by related or opposed forestry and tourism developments. Heterogeneous engineering thus crucially includes the manufacture of conditions that would favour the construction of the reservoir, or make it impossible. This refers both to the reservoir area directly – including its forests, population and livelihoods – and to the images people have about the reservoir and its alternatives. A central aspect of planning and management is thus “persuasive and constitutive storytelling about the future” (Throgmorton, 1996, cited in Suchman, 2000: 319). As I summarised above, previous research has illustrated some of the dimensions of forging and managing promises. What I would like to emphasise in this section is that for the local reservoir opposition, the making – or rejecting – of possible futures for the area is closely related to their current and past experiences with the river and its surroundings. This observation resonates with Ingold’s characterisation of imagining futures, which “is not so much to conjure up images of a reality ‘out there’, whether virtual or actual, true or false, as to participate from within, through perception and action, in the very becoming of things” (2012: 3). The persuasiveness of future-making is not achieved out of the blue, but tightly linked to lived life.

For the hydropower company, the issue has increasingly become one of constructing the *need* for a reservoir, more than the reservoir itself. Whereas in its original plan, the justification of the reservoir – resource development, electricity production, energy independence – seemed self-evident and the challenge was to physically construct it, now the challenge became to construct it socially, too. In Abram and Weszkalnys’s (2013) terms, this means that in the process of aspiring to fulfil the “elusive promises” of planning, the promises themselves become re-defined. If at one stage, the proponents’ promise concerned large-scale development and modernisation of an economically disadvantaged and physically opportune region, at another stage they promise a flood protection scheme with integrated environmentally benign electricity source. On the Kemi, this is reflected in the ongoing physical redefinitions of the reservoir. Whereas the general position and main purpose of the reservoir have remained the same, the hydropower company had made various adjustments of its size, design and scope to the plans over time, catering to previous criticisms. In the process, they recast the project as no longer the environmental threat for which it had been rejected twice, but as rather an environmental *asset*, producing renewable, carbon-neutral energy, providing flood control, and enhancing nature-based tourism. To this end, the planners included secondary dams in the revised plan, to reduce the extent of fluctuation in water surface area as well as to exclude from the reservoir some of the places that had been identified as unique natural sites. These sites included a set of river islands and some sections of smaller tributaries, the water of which would then have to be pumped into the higher-level reservoir across the dam. Furthermore, reservoir proponents inserted a number of wind turbines into the plan, adding to its message of an environmentally benign energy producer; and they marked an area on the shore of the planned reservoir for holiday homes, emphasising the recreational value of the project. By publishing an entire series of reservoir alternatives, the prospective developers also signalled readiness to compromise and openness to deliberative decision-making.

This rebranding exercise does not mean, of course, that the problem has become purely discursive in a limited linguistic sense. Rather, the arguments, strategies and subject positions of the various conflict participants were imbued with material processes and embodied experiences. The recent re-invention of the project as a “multiple-use reservoir” or even flood control device, for instance, played on the residents’ experiences with flooding as well as on their love for water in recreation and their passion for fishing. Fishing proved indeed a very contentious issue in these engineering efforts. Project proponents persistently named both recreational and professional fishing as advantages of a “multi-use” reservoir, invoking the allegedly positive experiences with fishing on the Lokka reservoir on one of the Kemi’s tributaries. A local cooperative had established a fishing harbour and fish-processing facility there, and some hoped that the livelihoods displaced by the reservoir and wider economic restructuring would be replaced by fishing. After all, the huge water body, while it drowned villages, fields, forests and reindeer pastures, also provided ample habitat for fish. However, reservoir opponents also used the same case of the Lokka fishery to point to the destructive effects of reservoirs: not only had more appreciated fish species, like grayling, disappeared from the waters, but also was the fish that was caught said to be small in size and “full of maggots”. The activists cited reports of the Game and Fisheries Department, for instance, indicating that the reservoir did produce fish, but not of the right kind, with species like whitefish multiplying at a very fast rate, but “dwarfing” at the same time so that most of the fish caught were too small for economic use.

Reservoir proponents were faced with the challenge to engineer a reservoir that caters for fish and fishing interest, taking into

account, on the one hand, the popularity of fishing and the image of Lapland as clean fishing ground, and on the other, a large array of negative experiences with fishing in similar reservoirs. For instance Lake Kemi, only about 50 km downstream from the projected reservoir, was also used as a hydropower reservoir and displayed the annual water fluctuations typical of northern hydroelectricity facilities. Fishers had very negative memories of the effects of these fluctuations. As the hydropower company regularly emptied large parts of the reservoir during the winter, wide and muddy drawdown zones appeared along the shores in spring, when some of the fish tried to spawn in vain. Instead of the flooded shore vegetation, they found muddy ground where spawning often failed. Rather than a fish-paradise, in the words of one opponent, the planned Vuotos reservoir would be a “frog-paradise” (Autti, 1999: 24). Some fishers on Lake Kemi even claimed that the large fluctuations of water level – 7 m in Lake Kemi, and eight in the Vuotos project – drove the fish away into other water bodies. Many of the older ones remembered the decline in water quality that affected the fishery during the first years of reservoir use, when the water level fluctuations washed out large amounts of organic material. When other hydropower stations were constructed on another tributary upstream from Lake Kemi, fishers noticed the effects on water quality by the amount of mud that got stuck to their nets. Some scenarios for the Vuotos reservoir even suggested that because of the washing out of heavy metals, fish from its waters would be unsuitable for sale or consumption for the entire first decade of its use. A lot of this concern about fishing came from the Lake Kemi area not only because of its own experiences with reservoir fishing, but also because it is the first lake downstream of the planned reservoir, which means that a large share of the organic and poisonous material washed out from the new reservoir would settle there. This relationship between an upstream reservoir project and downstream opposition illustrates how the river water and its dynamics of erosion and sedimentation can directly influence the constitution of the conflict and the terms of engineering.

Also the more recent ordering attempts of reservoir proponents are subject to profound criticism; their promises for regional futures, as well as their ideas for achieving them, are questioned both in principle and in detail. One activist, for instance, has accused the Council of Lapland, key promoter of the recent “flood protection” reservoir, for assuming an illegitimate role in the planning process. If a flood management strategy was to be developed according to EU Directives, so the critic, then this should be the responsibility of the Finnish Environment Institute, not of a development planning committee known for its fondness of hydropower reservoirs (Krause, 2013a). Also, the same reservoir opponent added, any drafting of futures should be in accordance with the relevant legislation; planning centred on a project that has been declared illegal due to its environmental impacts must be illegal, too. Instead, the Council of Lapland, funded by taxpayers’ money, should work democratically, for instance in the way its flood management experts are selected, and abide by the law, not spending their budget on an “illegal project”.

Performing a reservoir future can also take the form of repressing other futures. Activists pointed out that even today, more than ten years after the Supreme Court’s verdict against the project, the area intended for the reservoir remained as a white spot on the local municipality’s land use planning map, and the *Natura 2000* status of some of this area has not triggered any tangible changes. Instead of for example being declared a National Park or a local foods laboratory, the project territory remained in the ownership of the hydropower company, which seemed to lack an alternative vision for its use. This was particularly irritating for some reservoir opponents, who argued that the majority state-owned company has practically bought the land with tax-payers’ money, financed

through an increase in government-owned shares just before their largest purchasing wave. It would therefore be only fair, they felt, to return the land to the state. Reacting to a recent initiative by the Finnish Centre for Economic Development, Transport and the Environment, a government agency responsible for implementing central government policy, to finalise a concrete management plan for the *Natura 2000* area, the company declared it would not forfeit ownership because the present rejection of the reservoir project was interpreted as merely a manifestation of the current political climate. Under present conditions, the company agreed to the restrictions on forestry, building and hydroengineering on their land, but explicitly pointed out that these conservation measures may be abandoned once this climate changes (Kemijoki OY, 2013b). While the company performed the need for hydroelectric regulation capacity as a solid fact, it explicitly declared political and juridical decisions negotiable.

Conflict duration and life processes

In spite of the government and Supreme Administrative Court declaring the project abandoned in 1982 and 2002, respectively, the reservoir conflict has lasted for five decades, and no end is in sight. In that long process of landscaping and future-making, the conflict has developed its own dynamics, which spilled far beyond the original project and its target area: critics claim that local underdevelopment is caused, to a significant extent, by the uncertainty that people feel towards the area’s future and hence their reluctance to invest there, emotionally and economically; furthermore, the project has cut, or deepened, profound rifts in the community, between those accepting and those against the project (cf. Peuhkuri, 1996: 87–89). Passing, with time, through periods of various economic and political priorities and fashions, of climatic patterns such as flood-richer or -poorer periods, warmer or colder winters, and of technological contexts, including available nuclear power or electricity demand, the project and its opposition have been performed in accordingly different ways. As Adam (1995) points out, however, different moments do not just succeed each other, but they also accumulate and leave traces, many of them irreversible. Abandoned houses fall into disrepair, and while activist may fight for their ideals one decade, two decades, or even three, they become weary and frustrated.

Mervi Autti (1996, 1999) observed that because of the extensive discussions and transactions regarding the project, which have taken place throughout the previous half century, the reservoir already exists in a very real sense, no matter whether dams are going to be built or not. As a result of extensive land purchasing during earlier project phases, the hydropower company today owns more than 90% of the land in the area. Some reservoir opponents pointed out that the reservoir has to some extent already been built physically, for instance in so-called “experimental” ground works, where heavy machinery moved some soil in the projected reservoir area while the licensing procedure was still underway. They also observed changes in the reservoir area’s forests: where the reservoir was planned, the hydropower company had its forests clear-cut without replanting or sparing the immediate vicinity of watercourses, practices that are usually avoided in Finnish forestry. Only along the “shores” of the prospective reservoir have trees been left standing, so that the reservoir started to take shape in the forest. Presumably this was possible because the project was considered inevitable by the relevant decision-makers who accordingly granted special licences for otherwise questionable felling operations.

Neglected by their owner, the hydropower company that is evidently disinterested in local forestry, trees and brushes have regrown spontaneously since the 1990s, creating an uncomfortable sight for many Finns who take pride in their carefully managed and

regularly thinned forests, and a depressing prospect for the forestry workers of the area. The thickets that have replaced the formerly managed forests produce neither timber for local employment, nor pretty sights for inhabitants and visitors. Reservoir opponents thus argue that the very physical conditions of regional poverty and the “wastelands” deemed unattractive to tourists, which the reservoir project claims to abate by increasing employment and tax income, are in reality actively created by the project proponents.

Again, the engineering of the reservoir includes the manufacture of conditions favouring its construction. And time plays a central role in the process, both in terms of the futures discussed earlier, and regarding duration. The reluctance of the hydropower company to pass the ownership of the project land to the state, or the local municipality’s unwillingness to adjust their land use plan are cases in point mentioned above. By remaining inactive and maintaining the *de facto* existence of the reservoir project, they stall alternative developments and visions. In relation to the ongoing lives of the area’s inhabitants, this has tangible consequences. Alongside the adverse effects on communities and people’s scope for personal and professional development, it also reveals a fundamental inequality of the opposing parties in the reservoir struggle: while the members of the social movement grow old, frustrated and weary and are struggling to recruit their successors, the hydropower industry has at its disposal well-trained and well-paid professionals, who advance its cause during working hours, not in their spare time. When these professionals retire, they are replaced by a younger guard, with whom the activists have to go over much of the same ground again that they had already covered decades ago. In the long and tiring process of heterogeneous engineering in eastern Lapland, time as duration is not on the side of volunteer activists. Not only the materials employed by the engineer grow and corrode, but equally the project and, crucially, the engineers themselves change in time.

Conclusion

Studying the reservoir project as a set of conflicting performances, readjusting as the project unfolds and the rest of the world changes, clearly illustrates how opposing ordering practices are at once material and semiotic. The engineering involved in this construction is simultaneously social and hydrological; it is about changing the physical landscape as much as about the terms on which the struggle is fought and the futures that are promised in the process. It is, moreover, never complete – even after being declared unacceptable by the country’s highest legal authority, the reservoir soon reappeared on the planning scene.

Heterogeneous engineering is thus employed both in the attempt to build, and in the struggle to avoid the reservoir by constructing alternative futures that would not conventionally be regarded as “engineering”. I have argued for the continued usefulness of the heterogeneous engineering metaphor, and emphasised the significance of temporality. Reviewing a number of ordering practices of reservoir proponents and opponents, it has become evident that campaigning for an environmental project is necessarily a heterogeneous endeavour *in time*, performatively producing and transforming the material conditions under discussion alongside the terms of debate. My analysis thus concurs with Lippert’s (2015) arguments on the performativity of knowledge, but insists that knowledge-creation necessarily happens in the world, embedded in people’s experiences and projects in that world.

I have indicated that the heterogeneous engineering metaphor must not be seen as implying the strategic arranging of elements that are already constituted and readily available to the engineer. Rather, the material from Lapland suggests that it is only through people’s engagement with these elements, that they become

relevant in a particular way, and this way is not necessarily known – or even knowable – beforehand. This has been called “moments” in my analysis. Only through the temporal, situated practices of making and aspiring to projects of environmental change do material relations become formed and made to matter (see Rodríguez-Giralt, 2015). As the writing on performativity has pointed out, these processes can only happen in time, and it is in their time that things are made. Paraphrasing Suchman (2012), phenomena are not merely about the configurations that make them emerge, but rather about the practices of configuring, and continually re-configuring, the attempts to stabilise a particular trajectory.

I have also illustrated that heterogeneous engineering is directed towards a particular future, in the pursuit of an “elusive promise” performed in a simultaneously linguistic and material realm, in which promising, doubting, believing and counter-promising are enacted through boating tours as much as the display of maps, through the construction of bird-watching towers alongside the distribution of information brochures, or through forest management alongside the calculation of water lost to hydroelectricity. As Ingold (e.g. 2012) has suggested, imagination and the making of futures are grounded in present experience and perception, in which the environment only secondarily becomes an external reality for projecting these ideas. Primarily, the contested environment is also the world in which the contestants live their everyday lives, experience particular challenges and develop particular strategies and visions for dealing with them. Much of reservoir engineering and counter-engineering revolves around the struggle what sort of experiences are considered relevant, and which ones not, in a process that David Rojas (2015) calls “political aesthetics”. When attempting to bring about and stabilise a project of environmental change, be it a reservoir or a protected area, people work with existing flows of social and ecological developments and try to “bend [...] them to their evolving purpose” (Ingold, 2010: 92). This applies to fishing and flooding, bird migration patterns and nature conservation legislation, and electricity consumption and tourist enthusiasm – in short, the entire realm of environmental management.

Finally, I have emphasised the duration of environmental management projects. Whereas the bridge that Suchman studied was scheduled for completion within a time frame of five years, the reservoir struggle has lasted for five decades. This period has not only seen very different performances of reservoir project and alternatives, but also left its cumulative mark on the area’s inhabitants and landscapes. This leaves us with a profoundly temporal understanding of heterogeneous engineering, as a set of practices that necessarily unfold in time, that reconfigure time and that take time.

What, then, does the trope of heterogeneous engineering as outlined above offer for wider research on human engagements with their more-than-human environments? I would like to suggest four possible implications. First, by referring to “engineering”, the trope places specific and potentially conflicting human projects, ideas and practices at the centre of analysis, in an era where the acknowledgement of our more-than-human reality may easily gloss over the ethical dimensions of our actions. Second, by applying the metaphor not only to professional engineers, but also to the practices of activists working towards alternative projects, we can bring out both the technical expertise of non-certified experts, and the manifold wider challenges and skills involved in pursuing projects of environmental and resource management. Third, by highlighting three temporal dimensions central to the heterogeneous engineering surrounding the Vuotos project, I have pointed to the significance of time – as moments, futures and duration – in the performances of this project. Along with the landscapes and social relations involved, time is both a context and a product of

hydroengineering projects. While moments and futures have received some attention in previous writing about environmental management, the dimension of duration constitutes a particular sensibility emerging from the Vuotos case, which may be worth considering in the analysis of such projects more generally. Finally, I hope to have shown that environmental management in terms of heterogeneous engineering can be approached as a profoundly situated practice, where acting, imagining and enduring emerge from and are implicated in concrete fields of social and ecological relations.

Acknowledgements

The research on which this article is based has been supported financially by the Finnish Cultural Foundation and by Angus Pelham Burn. I am indebted to the openness and wisdom of the people on the Kemi River who have participated in the research. I am most grateful to Ingmar Lippert, Niklas Hartman and two anonymous *Geoforum* reviewers, whose comments have helped to clarify and improve my writing. The photograph used in the graphical abstract was taken by Helena Tiihonen and is reproduced with permission.

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