



Contents lists available at ScienceDirect

Geoforum

journal homepage: www.elsevier.com/locate/geoforum

Environment as datascape: Enacting emission realities in corporate carbon accounting

Ingmar Lippert*

Technologies in Practice Research Group, IT University of Copenhagen, Rued Langgaards Vej 7, 2300 Copenhagen S, Denmark
 Tembusu College, National University of Singapore, 28 College Avenue East, #B1-01, Singapore 138598, Singapore
 Chair of Sociology, Augsburg University, Universitätsstraße 10, 86159 Augsburg, Germany

ARTICLE INFO

Article history:

Received 5 March 2014

Received in revised form 21 September 2014

Available online xxxx

Keywords:

Accounting

Carbon

Data

Enactment

Ontology

Configuration

ABSTRACT

Ecological modernist approaches to climate change are premised upon knowing carbon emissions. I ask how corporate environmental managers know and do carbon, i.e., shape the reality of emissions. I argue that for managers' practical purposes carbon exists as malleable data. Based on ethnographic fieldwork over a period of 20 months in a Fortune 50 multinational corporation, I show that managers materially-discursively arrange heterogeneous entities – databases, files, paper, words, numbers – in and between office spaces, enabling them to stage emission facts as stable and singular. Employing Annemarie Mol's work on multiplicity, I show that multiple enactments of carbon hang together not by an antecedent body (CO₂) but through ongoing configurations of data practices. Disillusioning promissory economic discourses of 'internalisation', I demonstrate: Management is materially premised upon preventing purportedly internalised carbon realities from entering capitalist core processes. This undermines carbon economics' realist promises. Staging some carbon realities as in control is premised upon managers' ongoing, reflexive, partial and always situated configuration of, e.g., standards, formal meetings or digital data practices in which humans do carbon-as-data. Carbon practices are materially-discursively aligned, forming a configuration. This configuration effects carbon as a malleable and locally configurable space rather than as a closed fact. Reconstructing managers' practices as configuring carbon-as-dataspace, I argue, allows grasping adequately the contingency and constraints of managing carbon as a particular material-discursive form of environment. In conclusion I generalise the environmental management office as a space that can be configured to stage, beyond carbon, other global environments as well.

© 2014 Elsevier Ltd. All rights reserved.

Introduction

Dominant environmental politics and theories like 'ecological modernisation' position companies as key actors in transformations towards sustainability – conjuring up the imaginary of ecologically sound economies (see [United Nations, 1992](#); [Huber, 2008](#); [Mol et al., 2014](#)). Many critics of such politics consider capitalist companies relevant – even if their critique implies that they cannot achieve 'sustainability' (see [Levy, 1997](#); [Luke, 2013](#)). What does it mean, if a company says it is greening itself? What is the environment they are working on? What is the reality, i.e., what is the nature the company relates to? I engage with these questions by studying carbon footprinting.

Within science, sustainable development is identified as challenged by changing climates ([Beg et al., 2002](#)); at the same time, ecological modernisation is imagined as a path to achieve sustainability ([Christoff, 1996](#)), and ecological modernisation helps 'solving' climate crises ([Bäckstrand and Lövbrand, 2006](#)). Ecological modernisation is a form of reform in which environmental problems and economic growth are reconciled ([Buttel, 2000](#)), greening capitalism ([Huber, 1988](#)). Within ecological modernisation, policy and theories of social change towards sustainability meet in 'environmental footprinting' ([Mol and Spaargaren, 2000](#)). Turning climate change, then, into an issue of accounting is not surprising. [Lovell and MacKenzie \(2011\)](#) retrace accounting professions imagining climate change. Carbon accounting establishes footprints, and based on this knowledge policy is made. Or so the story goes. Vis-à-vis [Lovell and MacKenzie's \(2011\)](#) account, that details accounting professions' climate perspectives, I investigate how accountants do carbon in material-semiotic techno-managerial practice.

* Present address: Technologies in Practice Research Group, IT University of Copenhagen, Rued Langgaards Vej 7, 2300 Copenhagen S, Denmark.

E-mail address: lippert@ems-research.org

Drawing on ethnographic fieldwork in one of the 50 biggest companies, a 'Fortune 50' player, undertaken in 2008–2010, I reconstruct what the carbon emissions are that the company 'measures'. The effect of measuring emissions is not a representation of carbon 'out there'; but, for – what ethnomethodology would call – all the 'practical purposes' (Suchman, 2007) of carbon practitioners, the effect is carbon-as-data, existing in contingent material-semiotic practices (though, strategically, some of them would claim they relate to emissions 'out there'). It is the study of these practices – and of the material tools and things the practices engage – that can inform us *how* emissions exist in the company.

This introduction, first, foregrounds a key analytical move. Then I position how this move resonates with prior conversations in this journal and sketch the ethnographic study. Subsequently, I sketch the article's structure.

No company acts on its own. Rather, particular practitioners – called e.g., environmental 'managers' or 'accountants' – act on their objects (e.g., environmental entities), employing technologies and discourses. Depending on what these practitioners do, objects are, I will show, reconfigured. To substantiate this line of argument, I particularly draw on Mol's (2002) study of disease in a hospital. Following her, our studies should foreground practices that *do* something to or with entities, including objects and subjects. What practitioners do shapes entities and even brings these entities into being – such as a disease (she argues) or emissions (I show). In this approach, things are not antecedent to perceiving them but they are *enacted*. They come into being through acting. If practices enact things in particular ways they could also be enacted differently. This renders any enactment into an issue of politics of what is and could be: Ontological politics.

I link enacting things to datascape. Within actor-network theory, Latour (2004) engages with the enactment of reality by reworking the notion 'thing'. He thinks of things as assemblies of communities that decide what reality is. Etymologically, he retraces 'thing' to the *Thing*, the *Ding*, a 'quasi-judiciary assembly' (233). The assembly of all the forces and entities shapes the effect, the decision, the thing. Olwig (2002, 2005) takes us, etymologically and analytically, further by pointing out that assemblies also shape their land, i.e., *scape* the land; landscape emerges here as the effect of its Thing, the political body, that configures entities; '[t]he assembly, thus, can also be understood as forming environments' (Lippert, 2014b, 105). Complementarily, Tironi and Farías (submitted for publication) reconstruct parks as landscapes shaped by various meetings of differentially positioned actants. I use 'scape' to refer to the organisation, distribution, connection, patterning and configuring of enactments, to heterogeneously, unequally and differentially enacting things across various scales. The notion of *scape*, in other words, integrates an analytics that proceeds through ethnographic vignettes of enactments. My analysis proceeds towards analytics of datascape, explored in carbon-landscape enactments.

The article's thrust is: Environmental accounting practices are not mere technologies-of-representation but these practices co-configure how environments exist in the organisation. I, thus, analyse knowledge practices and their reality effects. This analysis builds on earlier work in Science and Technology Studies on the role of data infrastructures and memory practices (Bowker, 2005; Edwards, 2010) and on related work in geography: Whatmore (2006, 603) invites a 'shift in analytic focus from *discourse* to *practice*'. My analysis resonates with such a shift, as shared in *Geoforum*, especially in the issue edited by Bingham and Hinchliffe (2008). Part of this work is Asdal's (2008, 130) reconstruction of how numbers co-configure how natures are taken into account: 'Nature is not only made present and real through the instruments and materials of nature-parts and natural science, of politics and administration. Systems of accounting [...] also take part in these practices'. The present contribution to such analysis is to show

how environmental accounting is practiced in a place centrally integrated in the performance of capitalism.

I make present the 'centrality' to capitalism by sharing ethnographic accounts from the Fortune 50 player's sustainability unit. I call the company *Global Finance Quality* (GFQ).¹ GFQ has been one of the biggest capitalist players for many years – it manages itself 'successfully'. This allows studying how the environment is present in a place that is considered 'successful' in capitalist logic. GFQ operates financial services. That sector creates environmental impacts – in the company's logic by running offices (something 'all' companies do) and by way of financing other companies to conduct business (say, coal mining); the latter's impacts have been excluded from the financial player's environmental accounting. As a Fortune 50 player, what the company does are not idiosyncratically isolated activities but are part of global capitalist relations, including the world's biggest auditors, globally relevant ranking organisations (e.g., the *Dow Jones Sustainability Index*) and one of the world's biggest nature conservation NGOs. I take this setting as an apt inroad to a study of environment-in-practice within dominant forms of capitalism; although focusing on GFQ, implications beyond this particular company emerge (Lippert, 2014a).

My study focused on what carbon accountants do, which materials and tools they use, how they work in day-to-day practices. I followed environmental data across hierarchies and reconstructed corresponding data flows between organisational units, bookkeepers, databases, spreadsheets and team-meetings. Carbon accounting emerges as an avenue through which we can study the logics of how capitalism performs taking nature into account. 'Carbon' is not simply a name for molecules, but is deeply interwoven with technologies of accounting (MacKenzie, 2009; Lippert, 2012b). Analysing the practices of environmental accounting brackets the debate about whether market 'solutions' are good or bad (Lohmann, 2009). By studying the achievement of environmental realities through accounting, I complement recent debates about the market; studying accounting scrutinises the practico-foundational numbers, which are presupposed not just by the market but also any tax-based policy. These very numbers are imagined as well controllable entities in accounting and, correspondingly, as perfect candidates to control environmental impacts. Consider MacKenzie's (2009) account. While problematising conversion factors that translate various greenhouse gases into CO₂e, he concludes in terms of political attitudes, asking simply to improve markets. Blok (2011, 457) problematises MacKenzie's (2009) take, missing studies of the material-semiotic *politics* within carbon. MacKenzie (2009) as well as Lovell and MacKenzie (2011) invest optimism in actors and devices to get the numbers right. Yet, learning from Asdal (2011) I note: Numbers may be weak, may not perform well. Therefore, I ask: How do numbers and data perform in environmental accounting? I find that agents of ecological modernisation (Lippert, 2010a) practice carbon-as-data. Emissions, in corporate practice, are data entities that are not only used internally for resource governance but also released into discourses of climate change, sustainability and carbon economics. While concerned with inclusions and exclusions in doing carbon-data, I concentrate on the patterning, i.e., *scape*, of the realm in which carbon is brought into existence.

Approaching carbon accounting

To report its carbon footprint to publics, GFQ had first to establish this very footprint. Corporate carbon footprinting belongs to a set of knowledge-making practices that equip organisations with (accounts of) their environmental realities, e.g., resource flows

¹ Names of actors inside and around the company have been rendered anonymous.

and consumption, production of waste and emissions, in short, 'environmental impacts'. Some call such accounts 'physical information'; matching studies in corporate environmental management approach these environmental realities as antecedent, given. To illustrate, leading corporate environmental accounting scholars [Burrill et al. \(2011, 86\)](#) claim 'physical information is more often than not available and kept for bookkeeping purposes'. This stance enacts information about the environment 'out there' in a binary way – to be either existing or not, and as normally somewhere already existing. This imagines environmental accounting *as if* accounting directly knows the physical world it provides accounts of.

GFQ, too, approached carbon accounting as a pretty straightforward exercise. They asked bookkeepers working at their globally distributed subsidiaries to enter physical information about several key indicators (energy, water, paper consumption; waste and travel services) into a database. Headquarters based environmental managers acted as the carbon accountants who, in their story, then added up the numbers reported for these indicators and translated them into emissions facts using standardised carbon conversion factors. When all the data was accumulated they imagined stepping outside of the data, what [Haraway \(1988\)](#) would call performing a God-trick, to make the multinational company's emissions visible, generating a singular fact (e.g., 'GFQ emitted 4 tons of CO₂e per employee in the year 2010, compared to the baseline year a reduction of 11.4%'; GFQ defined carbon in terms of emissions per employee). I propose to critically analyse these seemingly simple steps – which so neatly fit flowcharts for data and organisational charts with clearly assigned responsibilities.

Struggling over emissions

As an entry-point to reconstructing the doing of emissions, we visit a meeting in which GFQ's top environmental manager, Frederik, presented a new type of table. The table made subsidiaries' average employee emissions comparable at one glance (CO₂e kg/employee, baseline year to last year). The table's and the meeting's objective was to inform and develop GFQ's carbon reduction strategy. While this particular table was discussed only at this meeting, similar meetings took place routinely. Such meetings involved, e.g., viewing, checking, discussing and physically handling data. We might think that once Frederik's emissions table was put on the meeting room's table, GFQ's emissions were represented, done. As if emissions depended on the inscription ([Latour, 1987](#)) only. My story is not just about inscription (and its constitutive devices) but also about how the meeting's participants related to emissions practically. We were four: Frederik, GFQ's sustainability manager Victoria, Frederik's assistant Elise and I.

Let us delve into the situation. Frederik distributed copies of a spreadsheet table that we simultaneously skimmed. While doing this, Frederik declared that something was wrong. He wanted us to return the tables. Some seesaw followed: First, Victoria, Frederik and Elise traced the content in depth, checking whether, or in which cases, numbers were correct. Without further explications, they agreed data was wrong. Uncontested, they collectively performed the data as erroneous. After a while Frederik offered an explanation: He had wanted to sort the rows by subsidiary; only the subsidiary column and not those with the numeric values have been sorted accordingly. Second, in parallel, Frederik suggested several times that he wanted the tables, tabloid sized, returned. The other three of us, however, did not want to return the copies to him. Still, he physically withdrew the tables he had given earlier to Elise and me. And he asked Victoria for hers. She did not return the table. They were literally tearing the material.

The situation turned when he asked for this: We had to faithfully promise that we would not use these numbers, would not show them to anybody. Victoria agreed. I proposed I would not show the numbers anybody within GFQ. Frederik countered: Self-evidently, you are not to show them to anybody outside. I agreed. Subsequently, he returned the tables to Elise and me.

In retracing the actions and entities within this meeting, I analyse three observations – about the technology of the emissions table, the stakes for participants and the reality achieved in this meeting.

First, an inscription device that comes immediately in focus is the emissions table. This table was a printed version of a spreadsheet, produced with Microsoft Excel™. That Frederik had brought the emissions on paper mattered. A paper could be easily taken away; and it allowed members to highlight locations on the paper. In contrast, digital versions were manipulable without leaving many traces; members could easily share them digitally. However, because members shared many files each day, sent myriads of emails, a paper version could exercise more weight in making emissions present than 'just' another xls file.

Second, attending to these practicalities is key to environmental agents' tactics. Once participants performed the table as erroneous, they had the option to move on to another topic. This, however, did not happen. Instead, all four agents verbally and physically expressed a strong interest in the table. I propose that this interest was situationally meaningful: The emissions table constituted the newest shared version of how emissions existed in the company. Practically, the emissions were constituted and shaped by this table. And patterns of this emission reality could be identified from this table independently of whether it contained errors; picture the rectangular shape of the table, rows for each subsidiary, eight similar but also different columns. In an organisational sense, knowing this reality's formatting was a form of power. As environmental practitioners they needed to know as much as possible about emerging forms of environments when they were assembled by colleagues or superiors. To be able to pursue tactics in their workplace, they needed to know the new emission realities, i.e., the effects of this particular practical way of assembling emissions. What this new emissions reality looked like was not self-evident – it could have been different. As [Haraway \(1988\)](#) reminds us: Any vision is partial; any device generating visibility is also blinding and silencing. Spreadsheets enact in/visibilities. At stake was how emissions became in/visible with this new technology.

Third, the meeting's members did not contest the erroneous relation between table and 'out there'. The struggle was not epistemic but about the material access to an emission reality and the trust in handling this reality well. We find that these practices did not only operate on the visibility of some antecedent emissions. Also, these practices shaped how emissions existed for the environmental practitioner. Frederik only allowed his colleagues to keep the tables once they agreed to constrain their usage of 'his' (erroneous) emission realities. That is to say, Frederik interfered in his colleagues' practical purposes. However, he did not and could not directly govern his colleagues' practical relations to the material emissions tables. Instead, he had to rely on their word. He had to trust they would not share the faulty tables with others. One way to understand this situation is that the technology of emissions was not only constituted by the paper of the emissions table but also by how the latter was assembled with the practitioners: When first handing out the tables, Frederik configured 'default' relations between tables and the environmental agents; they were allowed to use them for any of their professional purposes. However, once he modalised the table as erroneous, he first, but unsuccessfully, attempted to 'disassemble' this new configuration, and, as an alternative, he

resorted to 'alterassembling', i.e., to differently con-figuring, the humans and the emissions.

Interestingly, then, constitutive for the reality achieved by these humans and nonhumans were not just data, information, paper, spreadsheets or humans; significantly co-constitutive were practices of trust. Without Frederik's trusting some participants could not have materially accessed the emission reality. Clearly, these practiced relations were not merely about *Trust in Numbers* as Porter (1995) phrases it, but also about trust in humans (100, 214). I foreground: The reality of emissions is shaped by trust in humans. Frederik and the others were now subjectively and materially entangled in a relationship that was co-constituted by their performance of trust. Therewith, the humans did not simply trust some 'antecedent' object but they became part of the object, thus, partially reconstituting how they were subject to their material practices. In this interpretation, the humans together with the non-humans became a living entity that co-constituted emissions. Elsewhere I discuss this as an extended and distributed cognition machine (Lippert, 2011). The politics of this machine is distributed over its various constituents and the ways their relations are performed.

This discussion indicates that what emissions are for the practical purposes of practitioners is not very much about some antecedent molecules – independently of whether GFQ's accountants signify the latter as 'carbon', 'CO₂e', or as 'greenhouse gases' in formal documents. Much rather, for practitioners' practical purposes (in contrast to their formal claims), emissions seem to be the ongoing sociomaterial practices that relate particular humans and non-humans. This consideration needs to be spelt out conceptually.

For Mol (2002, 5) 'ontology is not given in the order of things, [...] instead, ontologies are brought into being, sustained, or allowed to wither away in common, day-to-day, sociomaterial practices'. She proposes the concept enactment to point to how entities are materially-semiotically brought into reality as well as maintained, altered or made absent. Following her, asking what a particular entity 'is' – or for that matter what emissions 'are' – shifts from a determinate meaning to a situated meaning. Being is situated (54).

Along these lines, Frederik's moves emerge as practicing a particular ontology, i.e., enacting a particular reality. This misses a nuance. Significant in this situation was a mistaken reality that he had enacted. For considering the emissions erroneous, he was not committed to this reality. Interestingly, the reality he had produced was the effect of his practices that were committed to 'another' reality. He did not intend the error. Bringing into being an ontology, thus, does not necessitate that the actors involved are committed to that reality. If at all, commitments take part in the complicated politics of situated action. Making the achieved reality meet the commitments may involve further work. What emissions are, what nature is, thus can be expected to be a matter of complicated practical politics. A singular and coherent emission reality is not given but has to be achieved.

Of course, if emissions are in situated practices, then they are always some-where, some-time, some-how. Therefore, we need to enquire in the diversity of how emissions have been enacted – in and across different situations.

Carbon versions

The analytics pursued here insists that a variety of other enactments also take place outside of this particular meeting – not only in GFQ meetings but also in other organisations. To show the range and consequences of enacting data within GFQ, I retrace data practices from the imagined ground (visiting the sourcing of data) to final reporting (making GFQ's emissions publicly accountable). I

continue to draw on Mol's (2002) account. She finds that reality is not enacted in a singular way, but much rather in *multiple* practices that do not constitute a singular reality but multiple realities. I reconstruct how emissions can be conceptualised in terms of multiplicity, contrasting GFQ's 'standard'-ised accounting.²

A key premise of GFQ's accounting was that data are readily available, in the subsidiaries. This premise, however, did not hold and renders invisible the hard work of environmental bookkeepers to enact the very foundation which accounting would be based upon (Lippert, 2012a; 2013a, Ch. 2). In 'easy' cases, bookkeepers' work includes translating invoices into consumption facts. In this process only traces are translated from one inscription device (invoice) to another (e.g., a spreadsheet). I understand this as con-texting: What the texts of environmental data are and what their irrelevant context are is the outcome of such translation practices. Of course, con/text can always be done differently (Asdal, 2012). It was also completely normal that colleagues questioned these expected translations, requiring situated and practical engagement with the problems rather than standardised default responses (Lippert, 2012a; 2013a, Ch. 2; 2013b). The environmental data that is produced 'on the ground' is not given and determined by some external environment or is 'captured' by a standardised technique, but it is enacted in situated practices that arrange and assemble heterogeneous entities. A partial list of them includes the bookkeeper (i.e., the heterogeneous engineer himself; see also Krause, 2014), things that were enacted as 'sources', spreadsheets and phone calls to qualify data's meanings. The data enacted in these assemblages were later entered into a central database.

Storing data was not the only function of the database. It was built, too, to report data. The reporting algorithm translated the diverse environmental facts into CO₂e, employing conversion factors. The latter are by no means self-evident but constructed in techno-scientific investigations – in life cycle analyses (LCA); resulting not in facts read off 'nature' but contingent effects (Molloy, 2000; Roth and Bowen, 2001). For each subindicator a different factor was used. This was to link the eventually reported emissions to the emissions 'out there'. To illustrate, GFQ used a conversion factor of 0.18 kg CO₂e to translate a kilometre flown on short-haul flights into emissions while it used 0.11 kg/km CO₂e to translate long-haul flights.

At this step of the ideal connection further contingencies occur: For these specific factors to be applied correctly a subsidiary's data needed to fit precisely the distinctions of the factors (e.g., flight data needed to fit the categories 'short-haul' and 'long-haul' flights) and this fit was not self-evident (see Lippert, 2013a, 94–104; 2013b). Thus, resulting emissions were co-dependent on LCA practices as well as on the precise, situated, quality of the (non-)fit of local data with the conversion factors' assumptions of reality. Interestingly, while GFQ mostly claimed it used the VfU standard's conversion factors in its database GFQ partially employed non-VfU conversion factors that lowered emissions. The pair of conversion factors above (0.18 and 0.11 kg CO₂e) was sourced not from VfU but from WBCSD³ – because WBCSD excluded airport infrastructures from accounting for flights' effects on the atmosphere (while VfU included the airport infrastructures and, thus, would have led to 5–45% higher emissions). This constitutes economic externalities. Thus, emission facts are also co-enacted by the actual ways standards are interwoven in calculations. It is the practice of interweaving standard factors that configures conversion factors within the database, rather than the standard, that determines the configuration.

² GFQ's publications staged its environmental accounting as standardised by the Greenhouse Gas Protocol developed by the Global Reporting Initiative and a finance industry specific standard ('VfU').

³ World Business Council of Sustainable Development.

Yet, I cannot understand the reality of reported emissions by solely attending to the data enacted on the ground by bookkeepers. In addition, I also (would) need to trace the range of the processing, translations and shifts in data that are configured into the database (space does not permit reporting more results here; but see Lippert, 2013a, Ch. 5). And these configurations are decisive as well as problematic. They are adapted in relation to various tactical considerations.

After following through all these selected and/or not chosen paths of data transformations, data are reported as emissions-on-a-balance sheet. Such emissions are then used by the company to report them to other organisational units – *inter alia* to the PR department to create a glossy sustainability report but also to ratings and rankings, performing the greenness of GFQ publicly. For each of these parallel translations, data are remodulated, specifically con-texted and con-figured, to make carbon fit for documents' respective purposes. Here the story links to the 'capitalist market'⁴: For markets to 'work', its participants assumably need to know the goods and bads traded. The particularities of inscribing and formatting GFQ's emissions shaped how 'internal' and 'external' actors were informed.

For corporate carbon management as well as for carbon markets it is not molecules that matter in any direct way but data. Knowing emissions enacts the emissions – not by inviting 'out-there's' into the headquarters to touch data but precisely through the material practices of knowing the entity. In corporate practice, knowing and bringing emission into being are not distinct. If data can travel then corporate emissions can travel. 'GFQ's emissions' can be brought into existences within the company as well as outside, by an NGO, by shareholders, in this article. Thus, the social and material doing of data effects what emissions become the reality for their users. For a company's practical purposes, corporate emissions are the effect of these distributed and extended practices of accounting.

Finally, we need to recognise that yearly emissions are not established simply once. Consider the baseline year's emissions. These emissions kept changing as subsidiaries were in the process of learning the implications of the baseline (Lippert, 2013a, 488–499). The higher the baseline, the easier it was to perform emission reduction. In a phone conversation Frederik let me know it was very normal to retrospectively alter numbers. According to him 'numbers have always been changed'.

The database, thus, does not report once and forever, but users can generate many reports, each being travelling data, each co-constituting the emission realities depending on the particular database configuration. Resonating with changing 'foundational' data inputs and ongoing stabilisations as well as re-con-figurations within the database, the effective emissions change. Not one balance sheet is produced but many. Carbon realities come in versions. Within GFQ's data work, emission realities exist in spreadsheets: e.g., 'Version: 20.04.2009 10:22:42'. A spreadsheet without that information is quite useless; it might be out of date; then, in GFQ's logic, this reality should be discarded. Emissions thus are not only distributed over versions that travel organisationally but they also shift temporally.

Recognising unequal and materially heterogeneous distributions of emissions adds to my argument about emissions-as-datascape. Distributions of data are not arbitrary but contingent on how the dataspace is materially-semiotically shaped. In contrast to Mol's account of the body that is, eventually, singularised, GFQ's realities maintain their distributed and extended multiplicity,

accommodating emissions/versions discrepancies (e.g., various statuses of 'truth', authorisation or (non-)update).

This discussion proposes that accounting practices matter for what and how carbon exists in and for the company, and consequently, capitalism. The techniques of environmental accounting shape carbon. 'The plethora of techniques makes for a multiplication of reality.' (Mol, 2002, 75) The effect of how emissions are practiced is not so much a representation of carbon 'out there' but the effect is enacting carbon for all the practical purposes of their practitioners. And this reality of corporate emissions is not predetermined by molecules or standards but is contingent on how humans, spreadsheets, a central database, team meetings situationally interact. Still, molecules join the practices through complicated translations (partially interwoven with standards) that contingently and very weakly connect GFQ's practiced emissions to impacts 'out there'. Each eventual reality produced could have been practiced differently. The reality of carbon is better understood as multiple rather than as singular. Furthermore, not only is the reality of carbon multiple but also is carbon existing multiply: Many file versions of emissions exist and they travel. I, henceforth, conceptualise environmental reality as multiple mobile multiples. Emissions exist for situated organisational and economic practices in carbon-as-data, not in molecules. Carbon-as-data is not coordinated through some antecedent body but in the practices of enactment.

Ordering emissions

Recognising the multiplicity in carbon and the practical presence of various versions raises the question of how the emission scape was kept in order. This question exceeds a focus on trust in seemingly standardised and rigorous methods that allow numbers to be enrolled as objective. I am concerned here not only with the methods and particular numbers but also with the practices of achieving and ordering a space of numbers that can be tactically employed. Engaging with this question, I offer a twofold sense of order to understand environments-as-data. First, order is an achievement. Law (1994) calls us to study order as practice, ordering. Second, ordering emission versions means making some more present than others and that includes deleting as well as shifting versions. To extend our analysis of the ways emissions are aligned and directed, I engage with Suchman's (2012) work on *configurations as practice* and offer accounts of ordering – of learning and boundary-drawing.

The headquarters systematically reviewed subsidiaries' environmental balance sheets and translated subsidiaries' resource and service consumption into carbon emissions. The reviewed emissions versions were shared with subsidiaries' environmental managers. Sometimes Elise and Frederik accompanied these versions with questions (e.g., was the subsidiary sure about a particular number) or inquired into further creative possibilities to 'gather' data. In corporate logics, such requests for review constitute a form of quality control. Usually, 'quality control' denotes the idea that an 'increasing' quality is ensured. For GFQ's environmental data, however, what constitutes quality was highly situated: Members considered it a desirable quality to have data at all; Frederik sometimes resorted to what he called 'professional unprofessionality' to construct foundational data if subsidiaries could not enact the needed data. Doing data pragmatically sidelined explications of how data was enacted. The notion of 'control' is challenged when we consider the following: Because environmental balance sheets were sent back and forth between HQ and subsidiaries, environmental realities often stabilised only after several months, sometimes years, if at all. Frederik proudly cited the auditors, calling him 'out of control'. Despite auditor's recognition

⁴ While I address GFQ as participating in 'capitalist markets', I recognise that the data practices analysed in this paper are not necessarily unique to capitalist relations. Also non-capitalist markets may be configured by problematic accounting practices.

that GFQ's data was not well ordered, the auditors could not well hinder the data practices that were necessary to bring data into being.

GFQ's top environmental accountants approached shifts and hurdles in data as 'learning'. As described above, one particular 'quality' that was desirable for the company was to 'improve' and 'repair' baseline emissions. When subsidiaries found mistakes in baseline data that indicated that the baseline emissions had actually been higher, this was welcomed (while lower baseline emissions were not welcomed). So it was not surprising when Victoria approached data update requests in terms of 'corrections in which emissions improve'. 'Learning' and 'improving' emissions suggest that emissions are not merely the result of undirected encounters of actants but also of the tactical arrangement of relations within the company.

Briefly, I trace the directedness of enacting environmental realities in GFQ by attending to the boundaries that the company drew to include some environments in their accounting while excluding others. GFQ's accounting for environmental impacts by employing five 'key indicators' implied that other environmental impacts were ignored. The company attended to this through the notion 'system boundaries'. What was outside the boundaries constituted 'externalities' (in economics' terms) or 'overflows' (in the terms of the performativity of economics literature, [Callon, 1998](#)). Not within the frame of GFQ's environmental accounts were emissions related to, *inter alia*, the construction of offices they were using and emissions caused by GFQ's core practice (of investing money in other industries that enabled these industries to produce and, thus, to emit). So, all of this was excluded from GFQ's 'internalised' environmental realities. While the language of system boundaries renders the overflow present within the environmental management team, GFQ's PR agents would not emphasise the exclusions in, say, their corporate sustainability report.

Both approaches, 'learning' to 'improve' emissions and excluding environments from the accounts, are not some form of abstract greenwash but they are the effect of the material practices of GFQ's distributed actants. If a bookkeeper – mistakenly or subversively – included wrong environments (i.e. environments that officially were to be excluded; see [Lippert 2012a](#), 152–156) in environmental data, then different emissions would result. Prescriptive devices – like methodologies, standards, database interfaces or meetings with a boss – did not determine emissions but co-configured them. What emissions were enacted was always situated and, thus, contingent. Official plans were not in complete control (see [Suchman, 2007](#)). Mol's 'enactment' points us to reality-making's contingencies. With her I grasp the both knowledge and material character of enacting emissions through 'improving' emissions and excluding some environments from turning into corporate emissions at all.

As indicated, in 'improving' and boundary enactment I identify directedness. Humans, databases, standards, meetings, and other actants were subject to some of these actants' moves to align them in particular ways. Thus, emission practices did not cohere in some simplistic way but assembled (see [Mol, 2002](#), 150). Significant to the study of corporate carbon is that this assemblage was given direction – even if not determined by standardised methodologies – still effectively (see [Foucault, 1978](#), 94–95).

A generative way of conceptualising the tension between directedness and contingency in technological practices that enact realities uses the paired notion *configuration/configuring*. [Suchman \(2012\)](#) proposes to study heterogeneous assemblages that constitute IT devices and practices simultaneously as a configuration as well as existing through practice, i.e., configuring. Significantly, within configurations, diverse actors and entities can exist – existing in their configured/ing relations. Grasping configurations as material practices, IT devices themselves

emerge in a mode of ongoing reconfigurations. Within these relations, it is not necessary for every-thing and -body to practice shared imaginaries of what is happening or what the device is about. The effects of the practiced relations are the inclusions and exclusions, 'insides' and 'outsides' that are constitutive to the device. The agency and constitution of the entities' 'inside', respectively, is not antecedent but is the outcome of the practiced relations. Similarly, 'fixity of an artefact is an effect of reiterative enactments of a particular subject/object configuration, while fluidity articulates the inherent multiplicity of objects in ways that facilitate their travel' (56). Both, Mol and Suchman conceptualise stable, fixed, singular, particular 'things' as effects of material practices. Achieving such fixity, singularity and stability requires alignment work of ever-changing and mutually constituting non-antecedent entities. This alignment work would not be possible were the constituents intrinsically fixed. Entities need to be fluid and flexible – amendable to shifting relations within a particular configuration.

GFQ's drawing of system boundaries takes part in configuring what is 'inside' and 'outside', thus co-shaping what GFQ's environment is. Here we are in the realm of ontological practices. Boundary drawing co-enacts any organisation's environment. Boundaries, as formative relations, become part of the configuration. In addition, what counts as environment (for the company) is co-configured by the learning processes that change the constitution of versions of multiple environments over time. Engaging with an analysis that retraces such complexity and mess is particularly appropriate in the GFQ case because GFQ's agents themselves considered their carbon accounting apparatus messy, requiring too much maintenance and alignment work, and, as 'inefficient'. Considering problematic relations as well as entities and their shaping within the carbon accounting configuration, Frederik and Victoria considered these 'out of control'. This implied a call for getting carbon in control – to improve environmental reality's directability.

Optimising environmental reality-making

To get carbon in control, GFQ teamed up the environmental accountants with those actors in the company who, supposedly, were most experienced in directing the flows of the company's key reality: Financial data strategists. The structure of this optimisation process resonates with a practice reported by [Mol \(2002, 102\)](#). By deciding how a problem is treated members also opt for a technique that shapes how reality will be enacted. In short, I suspect this: Reality follows technique. Therefore, I retrace how environmental realities were prefigured in GFQ's data optimisation process.

Underlying the environmental and financial agents' cooperation was an analysis of GFQ's existing environmental data: A representation of their data practices in form of a 'business process model'. This took part in coordinating members' work. To understand corporate environments' coming into and shifting reality, I attend to the team's work of imagining and optimising their carbon accounting configuration.

When I had entered the field, the company had already decided that the accounting configuration was to be reworked. GFQ's 'progressive' paradigm shift was to tear down the walls between environmental and financial accounting. Greening-wise, this move fit perfectly the promises of ecological modernisation theory ([Mol, 2010, 23](#)): The environment was to move centre stage in the concerns of modern organisation – internalisation by processing 'the environment' like other data. While, officially, the precise future configuration was yet to be developed and decided upon, team members had informally settled two configuring moves: (a) GFQ was to phase out the database system they had used hitherto; instead environmental data would merge with financial data

inhabiting GFQ's SAP infrastructure⁵; (b) they enacted a dynamic colleague as a promissory agent – to substitute Frederik, who had, hitherto, closely attended to much of the messy-but-necessary alignment work. By excluding the old database and its manager, the sustainability team hoped to reduce mess and establish a configuration (a) they could effectively control, (b) to more easily stage emission facts as stable and singular.

When I first saw the business process model, I immediately sensed that GFQ's analysts had understood and depicted significant moments of their data practices' mess (Lippert 2013a, 328): We find 1.5 m of directed (arrows) and non-directed relations, rectangles, diamonds and ovals (distributed over six pages). Some months later, the group had succeeded; they had assembled a new emission accounting process – on paper: The new process fit just two pages, it was cleaned up. Diving into the group's meetings allows us to study how they achieved to optimise their practices.

Prefiguring problems

In one of the meetings, a financial data flow strategist shared reflections on how the transformation from the 'old' configuration to the 'new' would influence the processes of data gathering. Considering how data gathering should and might improve, the strategist remarked to the meeting: 'obviously, data quality won't improve either'. Then, Victoria pointed to subsidiaries having lump sum contracts: Invoices resulting from these do not split electricity, water and heating, but provide a total. She referred to subsidiaries in Malaysia and the US. Neither the old nor the new configuration could 'reasonably' construct high quality environmental facts based on totals. The strategy staff opinionated that they, too, could not sort out this problem. The strategist who had offered the remark asked: Would it be possible that suppliers break down the data? Directly, one of his colleagues countered: The Anglo-Americans won't. Victoria affirmingly shook her head. Those realities that for practical reasons could not be translated into data practices would emerge, systematically, as overflows.⁶

In another meeting strategists shared, they would not expect financial bookkeepers 'on the ground' to care for intricacies when entering environmental data. In the old configuration designated environmental agents were involved to enter data; and some of these actually cared about the data they entered. In contrast, 'normal' finance administrators would 'obviously' not interest themselves in something as irrelevant to their work routine as 'the environment'; hence, strategists foresaw missing care within the new configuration. Thus, while in the old configuration agents contained some overflows, the optimised approach was prefigured to overflow.

While the optimisation process was about improving the quality of emission data and of data practices, staff also identified infrastructural limits and mess. However, team members did not allow these limits to enter 'governance' talk about GFQ's environmental management system. Instead, the limits were to stay in the room. The limits to emissions were not to be communicated alongside the emissions, neither within GFQ nor to external actors.

Members discursively contained spreading the limits by way of translating neither the problems in nor the hitherto practiced messy solutions to data gathering into the 'optimised' emission accounting business process model. The new model enacted data gathering as a 'non-issue' (Rappert and Gould, 2014); the team

collectively ignored data mess, turned data into black boxes, hiding prefigured problems from the document's users. Realities of whatever matter that did not fit the form were not emitted by GFQ. Messy environments were not to enter the company's clean carbon accounts.

Organising trust

GFQ and their partners – a Big Four audit company and one of the world largest environmental NGOs – recognised that the emission reality was not in control, thus not trustable. Therefore, the optimisation team turned to organise trust via a proxy. The chosen proxy was a certification by an auditor, to signal that GFQ's emissions were all well. Victoria informed the group: Initially, the new software is supposed to be audited centrally; the Big Four auditing company is to audit the process of collecting data. And Frederik suggested, any audit of GFQ's financial accounting system would automatically co-audit their new environmental database system. In parallel Frederik whispered to me: Their NGO partner preferred another auditor, a 'green' one. Yet, GFQ, he elaborated, insists on their Big Four auditing partner.

The expected advantage for GFQ to work with the Big Four company was that the latter would focus auditing GFQ's accounting reality on financial data, i.e., on what 'really' mattered. GFQ expected the auditor to not worry much about environmental data. This also means that GFQ was not much concerned about the links between accounting and the imagined corresponding reality of emissions 'out there'. They worked towards optimising emission accounting such that the auditor stamps the emissions, renders the emissions trustworthy. To ensure this would happen, they prepared a presentation with a neat accounting model for the auditor, not representing actual problems and partial solutions in and to environmental accounting. The emissions of the new configuration were, thus, prefigured to exist as neat independently of their socio-techno-environmental messy character. Emissions reality was considered optimal – sufficiently optimised – if internal and external actors stopped questioning data, i.e., if GFQ could get an auditor to sign off their emissions-data as trusted. I conclude that for GFQ the effect of the carbon accounting configuration mattered, not the greenhouse gases emitted 'out there'.

The optimisation of corporate carbon accounting is particularly interesting because of the discursive-technical shifts that GFQ achieved. On the one hand the company managed to develop a system that could be performed as taking emissions seriously into the heart of the company. On the other hand, they could only enact this move successfully by means of excluding and ignoring problematic particularities of environmental data – i.e., by keeping Other environments out of the core. The new configuration would allow environments that easily fit the company's core to move to the centre; environments that did not fit in had to stay out.

This has two relevant theoretical implications. First, where the notion of overflows may suggest a clearly defined exclusion at, e.g., system boundaries, here are more messy exclusions. Strathern (2005) conceptualises how and where such kinds of overflows are effected: *Internally*. 'Internal externalities' are the product of the material and discursive practices that exclude, silence or make invisible particular realities in the midst of partially internalising projects. By way of taking nature into account it is not only some clearly defined overflows that are left out of the nature that will matter, but within those natures that are actively accounted for further significant realities cannot be accounted for.

Second, I reintroduce the notion of staging. This is helpful because it allows analytically differentiating enactments that actors are committed to and realities that actors are not committed to. While this analysis suggests, actors co-enacted all realities,

⁵ SAP is a leader in software systems that allow companies to manage and plan 'resources'.

⁶ If, for example, a subsidiary reported paper consumption but no data on electricity, water and heating then GFQ's data practices enacted emissions as only resulting from paper consumption with zero emissions from anything else.

actors recognise some of the realities accounted for as problematic. I here refer to GFQ's agents who identified problems, mess and overflows in environmental data practices. They achieved (a) to collectively *ignore* these problematic practices and (b) to collectively *stage* environmental data practices as manageable, effectively optimisable, in control. Engaging generatively with the corporate 'context' of data practices in this paper – resonating with critiques of formal accounting and audit as myths (Meyer and Rowan, 1991; Power, 1999; Boiral, 2007) – substantiated: The environmental performance of an organisation is precisely that – a performance, a staged exercise. GFQ's shaping of data practices only allowed to express alongside core financial data practices those carbon realities that they could stage as stable, singular, in control. Performing 'well' in environmental accounting means staging accounts for the purposes of the company.

Environment-as-datascape

This article grasps the contingency and constraints of managing environments by way of reconstructing managers' practices as configuring environments-as-data. The study contributes to an analytics of ontology-in-practice, in which 'reality is enacted', and not only matter of interpretation. My concern is not with how managers see the environment but how they achieve its existence in organisational reality. Studying capitalist corporate practice with this analytics, the concluding argument takes five steps, suggesting: The environment *within* dominant forms of capitalism (a) is not so much some environment 'out there' but, much rather, (b) are environments that exist as datascape.

First, this paper showed that various forms of environmental accounts were translated into carbon emissions. The emissions leaving the company were informational entities that informed discourses of climate change and co-produced the carbon economy. Environmental accounting does not simply represent some environment 'out there' but enacts carbon as an effect of socio-material-discursive, situated, assemblages. The company's emissions were co-constituted by the practices that made these emissions 'accountable'. Within these situated practices, the emissions leaving the company were configured in a directed (but not deterministic) manner. The company staged emissions as clear-cut, singular, transparent facts. However, emissions were also recognised (by corporate actors) as 'out of control', messy; emissions-in-practice are multiple, they come in many versions that shift and fluctuate over time, hang together not by means of some deterministic body (molecules or standards) but by means of the constituting configuration/configuring.

Depending on the particularities within ongoing configurings of environmental accounting, different realities are effected. The informational-technical infrastructure does not determine the environmental reality-as-data but co-configures the phenomenon. Although, partially, a configuration may be temporally stabilised, elsewhere more flexibility exists. A particular configuration, therefore, can co-effect a range of environmental realities. Thus, within configuring environments, it is not a singular reality that is produced but a space of multiple and situated possible realities.

Second, I reconstruct this space as scape. By this I mean that the dataspace is not homogenous, arbitrary or deterministic but that it contains differentiating material practices distributed heterogeneously within the space that achieve that some data are locally and materially-temporally stabilised while other data are rendered fluid or even more unstable. The space is, thus, structured through material-semiotic practices generating different environmental realities at different points, several of which are transformed into carbon-data layers that, again, are configured. The locally, temporally and historically specific practices qualify how carbon comes into being. Where landscape refers to the qualities embodied in

the land – inscribed into the land by the land's 'governing' assemblies (Olwig, 2005), carbon-landscape, or carbonscape (Lippert, 2013b, Ch. 6), refers to the shaping of the differentiated and heterogeneous distribution of qualifying material-semiotic practices that enact carbon. Differentially enabled and constrained actants scape carbon. Just like market design is ongoing politics within carbon markets' performativity (Blok, 2011), so is the space of (possible) emission realities enacted and shaped tactically.

Third, the participants in shaping environmental datascape are not in complete or 'global' control. Rather, any management or governance of and control over environments is materially and socially situated as well as partial. In the office, environments supposedly under management are socio-material data practices. That data comes with characteristics that undermine complete control: Digital environments are multiple, fluid and exist within multiple configuring enactments. Management practices can only 'access' environments in this complicated and messy realm. This implies, management can never grasp a complete environment: Internal externalities, prefigured overflows, shifting ontological statuses question the imaginary of 'control'. Any particular management act can only relate to the situated participants of the assembling encounter. At any point in time, GFQ's agents only engage with particular situated carbon realities – that a minute or, for that matter, years later could have easily changed. Again, the landscape metaphor is generative: Environment-as-datascape only allows local, situated relations. Managers practically work 'in' a landscape but not in the abstract 'on' it. Any imagined abstraction is merely a different form of practical configuration. Totality is impossible. Instead, managers can go to a particular place and manage from there, with the place's assemblages. Managers' practices co-configure the company's carbonscape. Any other environmental manager will be positioned similarly: Environmental management is enacted within socio-material-discursive datascape. Environments are not in control but are in enacted in configuring practices.

Data-as-practiced experienced non-predictable shifts. Indeed, emissions were 'out of control'. On that the environmental managers were right. Not exercising complete control also meant they could not successfully ensure the intended internalisation. These constraints, unfortunately, were multiplied by the relational requirements within which GFQ positioned itself: The company needed to stage itself as in control vis-à-vis investors, auditors and civil societies. A performance of control that ensures that problems, mess, contradictions and non-coherencies are not engaged with diminishes the possibility for explicitly situated 'accounts'. In other words, the management of environments was configured to be not accountable; the staging of facts was configured to *not respond* to critical questions – impossibilising GFQ to act responsibly.

Fourth, I generalise the environmental management office as a space that can be locally materially-semiotically configured to stage, beyond carbon, other globalised environments as well. GFQ actors several times suggested that climate change is a fad. Before 'carbon' they managed 'resources'. They 'knew', in a decade or so, the dominant environmental discourse may well overcome carbon. What comes afterwards? They mentioned 'water'. And this they translated into 'water footprints'. Alternatively, 'after carbon' the centre of capitalism might imagine its environmental relations through accounting for 'ecosystem services'. In parallel loom discourses of 'risk' management that demand environments to be staged as rational and in control. Within this landscape's situated norms and practices, environments-as-data are neither determined by some superior scientific or accounting standards nor by a profession's organisation but are tactically and generatively enacted to be compatible with capital accumulation. For the company the environment 'out there' does not matter. What matters for the company is to be able to generate facts that sustain the

organisation's relations – internally or with other players, be it the largest international environmental NGOs, auditing and standardisation organisations or governments.

How can the company ensure that their facts are not deeply questioned? It can achieve this by offering users' discourses what they need. Least of all, to stay successful, the company would want practitioners to care for particularities of the environments they exist through and off. Keeping those particularities that differentiate environments out ensures that the company can switch between environmental discourse by swapping conversion factor tables and by developing new spreadsheets: From carbon footprint tables to the next fad. Environmental datascape is structured to allow enactments for a variety of purposes, from resource and risk to reputation management.

The company is practically 'constructivist' behinds its realist epistemic performance. To sustain itself in the midst of environmental discourses and ever-new discourses that point to local and global environmental issues, the easiest is to respond superficially while ensuring that the company can easily flick between discourses. The more environmental accounting is configured formable, the more profitable it is for the company. The more realities the company's managers ignore, the 'better' they perform capitalism. These conclusions question the promissory accounts by ecological modernisation scholars like Arthur Mol (2006, 2010) as well as MacKenzie's (2009) optimism.

Finally, these considerations question how to imagine interventions in environmental management – in datascares and offices. GFQ's top environmental managers knew perfectly that they perform environments in particular ways, that they could enact different environments and that they were supporting a particular tactics of attempting to make capitalism engage with the environment. 'Managing' environments can be staged in the face of catastrophic circumstances that make plain evident for managers that their approach to management guarantees everything but challenging destructive business (see also Rojas, in press; Lippert, 2010b). Drawing tactically and creatively on the datascares, managers can easily stage environments that satisfy policy demands for clear facts and figures. This supports mutually affirming performances in *de facto* collaborations of environmental managers, PR agents, standardisation and professional organisations. My analysis calls to question not merely specific numbers and facts but the reconfigurations of and in environmental-dataspaces, i.e., environments-as-datascares.

Readers might then ask what environmental managers should do. It would be foolish for me to end with a simplistic call for a particular new standard, a new recipe that everybody, every organisation, should adopt. If the 'solution' is not something that can simply be implemented, how else to proceed? I see this analysis as calling for subversive research. We might be moving on if we engage with environmental managers as situated practitioners, undermining dominant configurations/configurings: Working towards opening up environmental practices for critical reconfigurations.

Acknowledgements

The work underlying this analysis was conducted while I was supported by scholarships by Hans-Böckler-Foundation and the German National Academic Foundation. The analysis would not have been possible without GFQ and its sustainability staff granting access for fieldwork. I would like to thank two anonymous reviewers for their comments on an earlier draft of this essay. I am particularly grateful for generative conversations with Christoph Lau and Lucy Suchman and for detailed questions and comments by Christopher Gad, Rachel Douglas-Jones, Niklas Hartmann, Franz Krause, Lydia Stiebitz and Steffen Dalsgaard.

References

- Asdal, Kristin, 2008. Enacting things through numbers: taking nature into account/ing. *Geoforum* 39 (1), 123–132. <http://dx.doi.org/10/bt8bsn>.
- Asdal, Kristin, 2011. The office: the weakness of numbers and the production of non-authority. *Account. Org. Soc.* 36 (1), 1–9. <http://dx.doi.org/10/c82v9p>.
- Asdal, Kristin, 2012. Contexts in action—and the future of the past in STS. *Sci. Technol. Human Values* 37 (4), 379–403. <http://dx.doi.org/10/t4x>.
- Bäckstrand, Karin, Lövbrand, Eva, 2006. Planting trees to mitigate climate change: contested discourses of ecological modernization, green governmentality and civic environmentalism. *Global Environ. Polit.* 6 (1), 50–75. <http://dx.doi.org/10/fjg3w6>.
- Beg, Noreen, Morlot, Jan Corfee, Davidson, Ogunlade, Afrane-Okese, Yaw, Tyani, Lwazikazi, Denton, Fatma, Sokona, Youba, Thomas, Jean Philippe, Rovere, Emilio Lèbre La, Jyoti, K., Parikh, Kirit Parikh, Atiq Rahman, A., 2002. Linkages between climate change and sustainable development. *Clim. Policy* 2, 129–144. <http://dx.doi.org/10/dmf8f2>.
- Bingham, Nick, Hincliffe, Steve, 2008. Reconstituting natures: articulating other modes of living together. *Geoforum* 39 (1), 83–87. <http://dx.doi.org/10/cwsd63>.
- Blok, Anders, 2011. Clash of the eco-sciences: carbon marketization, environmental NGOs and performativity as politics. *Econ. Soc.* 40 (3), 451–476. <http://dx.doi.org/10/dmnp9f>.
- Boiral, Olivier, 2007. Corporate greening through ISO 14001: a rational myth? *Organ. Sci.* 18 (1), 127–146. <http://dx.doi.org/10.1287/orsc.1060.0224>.
- Bowker, Geoffrey C., 2005. *Memory Practices in the Sciences*. MIT Press, London and Cambridge, Massachusetts.
- Burritt, Roger L., Schaltegger, Stefan, Zvezdov, Dimitar, 2011. Carbon management accounting: explaining practice in leading german companies. *Aust. Account. Rev.* 21 (1), 80–98. <http://dx.doi.org/10.1111/j.1835-2561.2010.00121.x>.
- Buttel, Frederick H., 2000. Ecological modernization as social theory. *Geoforum* 31, 57–65. <http://dx.doi.org/10/dgtx5h>.
- Callon, Michel, 1998. An essay on framing and overflowing: economic externalities revisited by sociology. In: Callon, Michel (Ed.), *The Laws of the Markets*. Blackwell, Oxford, Malden, pp. 244–269.
- Christoff, Peter, 1996. Ecological modernisation, ecological modernities. *Environ. Polit.* 5 (Autumn), 476–500. <http://dx.doi.org/10/drwwb8>.
- Edwards, Paul N., 2010. *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming*. The MIT Press, Cambridge (Massachusetts), London.
- Foucault, Michel, 1978. *The history of sexuality*. Translated by Robert Hurley, vol. 1. Pantheon Books, New York.
- Haraway, Donna, 1988. Situated knowledges: the science question in feminism and the privilege of partial perspective. *Feminist Stud.* 14 (Autumn), 575–599. <http://dx.doi.org/10/bvtwq4>.
- Huber, Joseph, 1988. *Die Regenbogen-Gesellschaft*. Fischer-Taschenbuch-Verlag, Frankfurt am Main.
- Huber, Joseph, 2008. Pioneer countries and the global diffusion of environmental innovations: theses from the viewpoint of ecological modernisation theory. *Global Environ. Change* 18 (3), 360–367. <http://dx.doi.org/10/cmjsvq>.
- Krause, Franz, 2014. Making a reservoir: Heterogeneous engineering on the Kemi River in Finnish Lapland. *Geoforum*. <http://dx.doi.org/10/wm7>.
- Latour, Bruno, 1987. *Science in Action: How to Follow Scientists and Engineers through Society*. Harvard University Press, Cambridge, Massachusetts.
- Latour, Bruno., 2004. Why has critique run out of steam? From matters of fact to matters of concern. *Crit. Inquiry* 30 (Winter), 225–248. <http://dx.doi.org/10.1086/421123>.
- Law, John, 1994. *Organizing Modernity*. Blackwell, Oxford, UK.
- Levy, David L., 1997. Environmental management as political sustainability. *Organ. Environ.* 10 (2), 126–147. <http://dx.doi.org/10.1177/0921810697102002>.
- Lippert, I., 2010a. Agents of Ecological Modernisation. DAV, Marburg.
- Lippert, I., 2010b. Disposed to unsustainability?: Ecological modernisation as a techno-science enterprise with conflicting normative orientations. In: Bammé, G.G., Wieser, B. (Eds.), *Yearbook 2009 of the Institute for Advanced Studies on Science, Technology and Society*, Profil, München, pp. 275–290.
- Lippert I., 2011. Extended carbon cognition as a machine. *Computational Culture* (1). <http://computationalculture.net/article/extended-carbon-cognition>.
- Lippert I., 2012a. Carbon classified?: Unpacking heterogeneous relations inscribed into corporate carbon emissions'. *Ephemeria* 12(1/2), 138–161. <http://www.ephemerajournal.org/sites/default/files/12-1lippert.pdf>.
- Lippert, I., 2012b. Carbon dioxide. In: *Encyclopedia of Consumption and Waste: The Social Science of Garbage*. Sage Publications, pp. 105–108. <http://dx.doi.org/10.4135/9781452218526.n44>.
- Lippert I., 2013a. Enacting Environments: An Ethnography of the Digitalisation and Naturalisation of Emissions, PhD thesis, Augsburg University, Philosophisch-Sozialwissenschaftliche Fakultät, <http://nbn-resolving.de/urn:nbn:de:bvb:384-opus4-21997>.
- Lippert I., 2013b. Calculative Enactment of Certainty: Achieving Environmental Data in a Fortune 50 Company. Paper presented at Asia-Pacific Science, Technology & Society Network – Biennial Conference 2013 (Singapore, 15–17 July).
- Lippert, I., 2014a. Studying reconfigurations of discourse: Tracing the stability and materiality of "Sustainability/Carbon". *Journal for Discourse Studies – Zeitschrift für Diskursforschung* 2 (1), 32–54.
- Lippert I., 2014b. Latour's Gaia – Not down to Earth?: Social Studies of Environmental Management for Grounded Understandings of the Politics of Human-Nature Relationships'. In: Bammé, Getzinger G., Berger, T. (Eds.),

- Yearbook 2012 of the Institute for Advanced Studies on Science, Technology and Society. Profil, München, pp. 91–111.
- Lohmann, Larry, 2009. Toward a different debate in environmental accounting: the cases of carbon and cost–benefit. *Account. Org. Soc.* 34 (3–4), 499–534. <http://dx.doi.org/10.1016/j.aos.2008.03.002>.
- Lovell, Heather, MacKenzie, Donald, 2011. Accounting for carbon: the role of accounting professional organisations in governing climate change. *Antipode* 43 (3), 704–730. <http://dx.doi.org/10/d2bxzj>.
- Luke, Timothy W., 2013. Corporate social responsibility: an uneasy merger of sustainability and development. *Sustain. Dev.* 21 (2), 83–91. <http://dx.doi.org/10.1002/sd.1558>.
- MacKenzie, Donald, 2009. Making things the same: gases, emission rights and the politics of carbon markets. *Account. Org. Soc.* 34 (3–4), 440–455. <http://dx.doi.org/10.1016/j.aos.2008.02.004>.
- Meyer, John W., Rowan, Brian, 1991. Institutionalized organizations: formal structure as myth and ceremony. In: Powell, Walter W., DiMaggio, Paul J. (Eds.), *The New Institutionalism in Organizational Analysis*. The University of Chicago Press, Chicago, London, pp. 41–62 (Chapter 2).
- Mol, Annemarie, 2002. *The Body Multiple: Ontology in Medical Practice*. Duke University Press, Durham, N. Ca., and London.
- Mol, Arthur P.J., 2006. Environmental governance in the information age: the emergence of informational governance. *Environ. Plann. C: Government & Policy* 24 (4), 497–514. <http://dx.doi.org/10.1068/c0508j>.
- Mol, Arthur P.J., 2010. Social theories of environmental reform: towards a third generation. In: Gross, Matthias, Heinrichs, Harald (Eds.), *Environmental Sociology: European Perspectives and Interdisciplinary Challenges*. Springer Verlag, Dordrecht, Heidelberg, London, New York, pp. 19–38 (Chapter 2).
- Mol, Arthur P.J., Spaargaren, Gert, 2000. Ecological modernisation theory in debate: a review. *Environ. Polit.* 9 (1), 17–49.
- Mol, Arthur P.J., Spaargaren, Gert, Sonnenfeld, David A., 2014. Ecological modernization theory: taking stock, moving forward. In: Lockie, Stewart, Sonnenfeld, David A., Fisher, Dana R. (Eds.), *Routledge International Handbook of Social and Environmental Change*. Routledge, Oxon and New York, pp. 15–30 (Chapter 2).
- Molloy, Eamonn, 2000. *Management Technologies: Ideas, Practices and Processes*. PhD Diss., Lancaster University, Sociology Department.
- Olwig, Kenneth R., 2002. *Landscape, Nature, and the Body Politic: From Britain's Renaissance to America's New World*. University of Wisconsin Press, Madison.
- Olwig, Kenneth R., 2005. Representation and alienation in the political land-scape. *Cult. Geogr.* 12 (1), 19–40. <http://dx.doi.org/10.1191/1474474005eu321oa>.
- Porter, Theodore M., 1995. *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton University Press, Princeton, New Jersey.
- Power, Michael, 1999. *The Audit Society: Rituals of Verification*. Oxford University Press, Oxford.
- Rappert B. Gould C., 2014. *Biological Weapons: Convention-confidence, the prohibition and learning from the past*, Institute for Security Studies Papers (258). <http://www.issafrica.org/publications/papers/biological-weapons-convention-confidence-the-prohibition-and-learning-from-the-past> (accessed 26.10.14).
- Roth, Wolff-Michael, Bowen, G. Michael, 2001. 'Creative Solutions' and 'Fibbing Results': enculturation in field ecology. *Soc. Stud. Sci.* 31 (4), 533–556. <http://dx.doi.org/10.1177/030631201031004003>.
- Strathern, Marilyn, 2005. Externalities in comparative guise. In: Barry, Andrew, Slater, Don (Eds.), *The Technological Economy*. Taylor & Francis, London and New York, pp. 66–83 (Chapter 3).
- Suchman, Lucy, 2007. *Human–Machine Reconfigurations: Plans and Situated Action*, second ed. Cambridge University Press, New York.
- Suchman, Lucy, 2012. Configuration. In: Lury, Celia, Wakeford, Nina (Eds.), *Inventive Methods: The Happening of the Social*. Routledge, London, New York, pp. 48–60.
- Tironi M. Fariás I., Building a park, immunising life: environmental management and radical asymmetry, *Geoforum*, submitted for publication.
- United Nations, 1992. Agenda 21. <www.un.org/esa/sustdev/documents/agenda21/english/Agenda21.pdf> (accessed 09.11.04).
- Whatmore, Sarah, 2006. Materialist returns: practising cultural geography in and for a more-than-human world. *Cult. Geogr.* 13 (January), 600–609. <http://dx.doi.org/10/b9rdxs>.