Neoliberal Timescapes of Infrastructuring an Environmental Footprint: Configuring Carbon Emissions as Flexibly Substitutable Placeholders

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Abstract
Environmental discourses shift over time. Corporations are interested in maintaining efficient systems that translate their operation's environmental impacts into specific environmental discourses, such as carbon. For this purpose, corporate environmental management systems employ accounting. In accounting apparatuses material environmental relations are represented digitally. I attend to maintainers of such digital infrastructures and analyse how they enact the corporation's environmental relations as sufficiently stable. I show that achieving such stability over time is indeed a critical project because the socio-technical relations of the infrastructure routinely threaten such stability. To devise a time-sensitive infrastructural analysis, this problematisation adopts Barbara Adam's timescapes perspective and Lucy Suchman's concept of configuration. Annelise Riles' notion of the placeholder supports theorising the specific political quality of the infrastructural relations. I draw on ethnographic research into corporate carbon accounting in a transnational company. The empirical material consists of an ethnographic story composed of key artefacts of the accounting infrastructure and participant observation of situated engagements with these artefacts by the environmental managers; specifically, I address situations in which participants enact too swift emission reduction, the synchronisation of emissions and the versioning of environments. This story powers detailing how time is imagined and inscribed in critical infrastructural relations. Across these analyses, I problematise how the managers of these corporate carbon emissions continuously (re)configure the latter into an appropriately flexible environmental reality. In sum, I argue that complex temporal politics are at work within maintaining emissions in the corporation to produce tailored versions of environmental realities, effecting a neoliberal timescape.

Keywords
neoliberalism; time; placeholder; carbon; accounting; capitalism.

1. Introduction

The Anthropocene finds critics questioning the role of capitalism in that era (Moore 2016). Temporality matters in both, the Anthropocene and in capitalism. Bensaude-Vincent (2022)

sensitises us to the power relations stabilised through the imaginary of linear scales characterising the Anthropocene, and calls for an analytics of the Anthropocene's timescapes. However, Nordblad (2021, 341) argues for turning our attention from conversations about the Anthropocene to the temporalities of climate change, as the latter invites attention to the way the "political present" is connected to "long term" change. Whilst across disciplines climate change has been analysed as perceived through time (Pahl et al. 2014), how specifically time is evoked as a resource and as a medium for sustainability governance is a much more recent concern (Bornemann and Strassheim 2019). Corporate sustainability governance connects the political present to the long term issue of climate change by mobilising technologies of accounting and accountability – to know their environmental impact and present themselves as responsible environmental citizens (e.g., Rämö 2011), in a mode of self-governing, characterising neoliberalism (Wickramasinghe et al. 2021). In the borderlands between STS, studies of the anthropocene and climate change and critical studies of accounting and finance, with an interest in timescapes, I ask how corporations achieve carbon accountably in and with time.

Contemporary hegemonic corporate environmentalism engages with questions of environmental crises very much in terms of climate change, specifically in the multi-governmental dispositif of carbon governance (Nyberg and Wright 2015). The large corporate players inhabiting the Fortune Global 500 list, which ranks companies by revenue, largely account for their environmental relations in terms of carbon (see review by Thaker 2019, 248). That the corporate environmental self takes the form of carbon resonates with an international regime of emission trading as a market solution to climate change[1] that – whilst deeply problematised in terms of the reliance of "counterfactuals in climate change mitigation" (Lohmann 2005, 203), in the way it imagines and configures selves as "do[ing] their bit" (Paterson and Stripple 2010, 341), as built on market solutionism (Leonardi 2017), which is now hidden within "sustainable responsible investment" (SRI, see Tarim 2022) or "environmental, social and governance" (ESG, see Dimmelmeier 2024) – is still maintained and innovated through policy proposals for tweaking international protocols (e.g., Michaelowa et al. 2022) to eventually deliver the desired emission reductions. In regional and national translations of the international regime, some corporations are legally obliged to reduce emissions (non-compliance risks being fined); other corporations are free whether to reduce emissions, for instance by buying offsets on the VCM, the voluntary carbon market (Lippert 2017). Reasons for such voluntary practice include, inter alia, reacting to public shaming and managing reputational risk (Harmes 2011). For governing such (imagined) emission reductions, emissions need to be rendered known, thus positing reliable accounting. STS has provided critical insights into the epistemic and calculative premises and infrastructures of emission trading and accounting (e.g., Lohmann 2005; 2009; MacKenzie 2009; Lippert 2018) and how these are enacted across scales of governance (Simons et al. 2014).

A key device in climate governance and its mundane management forms are baselines (see Ureta et al. 2020). These are key, because to reduce emissions by some percentage, the earlier emission state needs to be known. Of interest then are not only the large time horizons of geology, but also of recent pasts and near futures in the production of ubiquitous management entities like carbon footprints.

STS analyses of infrastructures are attuned to understanding the situated practices of maintenance and their entanglement with heterogeneous networks of humans, devices and discourses (Bowker and Star 2000). Much labour that achieves maintenance is hidden and silenced (Star and

Strauss 1999). Crucial to infrastructure not only for science, but also for governance, are numbers. Numbers are employed to strengthen relations of trust, by emphasising mechanical forms of objectivity over reliance on individual subjects (Porter 1995). The trope of the bean counting bookkeeper involved in accounting expresses that achieving and, then, employing numbers itself involves labour (Lippert and Verran 2018). The device of baselines can be infrastructurally located as part of accounting (Ureta 2018). And the saturation of heterogeneous accounting practices (Robson 1992) with temporalities within corporations is well established (e.g., Anderson-Gough et al. 2001; Keenoy et al. 2002). STS shows similarly that markets and trading involve temporalities, not only as a resource but also as a space that is actively shaped (e.g., Knorr Cetina and Bruegger 2002; Joerges 2003; Preda 2006). To understand the environmental governance dispositif, a study of early voluntary carbon accounting techniques can be helpful, as it provides insights on the installed base based on which contemporary practices of "greening" capitalism are built. To address these techniques, I need an analytics attuned to the ways relations are achieved between carbon, time and capitalism, as well as technologically and discursively co-configured.

With this paper, I mobilise ethnographic fieldwork from within a transnational corporation to explore how corporate carbon is known in situated practices, between devices, infrastructures and people. Seeking a contribution to an environmental STS focus on temporality within the social technology of corporate sustainability management, I am specifically interested in how baselines are achieved and how time is woven into environmental accounting knowledge practices. In that material-semiotic knowing, I argue, complex temporal politics is at work to produce tailored versions of environmental realities. I identify labour as a promissory focus for STS to trouble such reality-making.

In the following, I set out from laying out my analytical sensibilities, present the materials and methods and then present an empirically informed story of practices, agents and artefacts of the transnational's corporate social responsibility unit and the way they shaped the corporation's carbon footprint with and in time. In an analysis of the timescape of corporate carbon accounting, I develop a critical argument that problematises complex temporal politics within the transnational's infrastructure that risks "sustaining the unsustainable" (Blühdorn 2007). With that, I argue that the timescape I find can be well analysed as neoliberal.

2. Analytical Sensibilities: Configuring Timescapes in Data Practices

The timescapes analytics has been developed by Adam (1998). This approach is originally interested in the politics of industrial time, a Newtonian time, and its tensions with various forms of times in the wider techno-natural environment. As part of this, she is concerned with the way clocks and calendars shape organisations and cultures, how the dominant knowledge culture of science measures time, and how time is put to service for industry and economy. With that, she approaches time that is imagined and practised as a "resource that is open to manipulation, management and control" (Adam 1998, 11), allowing to "de-temporalise" time itself, and by extension other entities and relations. The dominant form of time appearing in clocks and calendars is abstracted from, and outside of, context, not affected by the time embodied within the phenomena. In contrast, she suggests, other and specific forms of time can exist within

interaction and relations, such as within environmental pollution, but also in the relation between sun, earth and a tree. Such latter forms of time, she argues, are Othered by Newtonian time, thus cannot be well accounted for within the industrial timescape[2]. The timescapes approach serves to tune into various knowledge forms that are differentially sensitive to how time works in techno-natural environments. The timescapes analytical sensibility provides resources for critically inventorising the various forms of times, temporalities within the phenomenon.

Towards analysing the relation between carbon, corporate conduct, clocked and calendared contexts, an analytics fit to analyse the relations woven between these is needed. Suchman's (2012) method device "configuration" has the capacity to address the ways imaginaries and specific materialities, more or less natural, are related. She invites us to explore what is figured within figures. This method calls for unpacking typically naturalised socio-technical artefacts. This provides insight into the various imaginaries, stories and investments that shaped the making of the artefact, it pays attention to what the artefact design takes into account: "every artefact enacts its singularity through delineations of that which it incorporates and those things that are beyond its bounds" (*ibid.*, 50). Specifically, through this method, the ways specifically formed figures are related move into the focus – where the effect of these relations constitutes a con-figuration[3]. Part of such configurations are the humans who engage in configuring, so that a configuration con-stitutes its subjects as well as objects. The figures, then, are themselves never antecedent, but have their own anteriorities; figures emerge as made, not found. Key for her is that by analysing configurations, the "politics of cultural historical imaginaries" (*ibid.*, 52) is problematised. Such understanding can help making artefacts, but also unmaking or remaking these.

To bridge the broad sociological critical timescape approach with the empirically detailing focus on configurations, I need a language that helps to analyse the way figures and formats are enacted over time, the way their relations are created, modified and destroyed, the way carbon is configured within short time horizons of corporate accounting practices. Riles's (2010) study of legal knowledge practices infrastructuring collaterals for finance hedgers provides such an analytic language. With it, we move attention from seemingly abstract ideas (which finance alike conversations about the Anthropocene or climate change are saturated by) to the epistemic-material engagement with documents. She focuses on how legal technicians achieve to facilitate relations of trust in trading "futures" between banks under conditions of less than full knowledge (because the future cannot be known). Placeholders stand out in her analytics. These are documentary technologies that get users to invest trust in the promised future, by "demanding" and "engendering" that trust (*ibid.*, 803). Placeholders achieve that by evoking sufficient certainty about a knowledge claim in the present while recognising that such a claim could be otherwise and allowing the claim to be revised in the future, when better knowledge becomes available. As an effect of such knowledge practices in the present, pasts and futures can be modified.

With these three authors' sensitivities, I suggest, we can approach analysing the modes in which timescapes are configured in data practices. I envisage an intersection of these analytics in the focus on how (carbon) figures are enacted in situated practices of capitalist forms of finance industry, and in how these figures' relations, their con-figuration, not only shape the subjects and objects involved, but also how present, past and future relate, and what these become. Thus, time emerges within this analytical apparatus as imagined, inscribed and materialised – as effect of a configuration.

3. Locating Materials and Methods

The material I present in this study is based in fieldwork across 20 months in a transnational financial services corporation, conducted between 2008-10 (Lippert 2013). The corporation belonged and still belongs to the global top 100 corporations, a Fortune 100 player. My work within the corporations' headquarters (HQ) was an effect of privileged access and the chance of compatible interests – I was searching for a site to study the lived culture of corporate environmental managers, "agents of ecological modernisation" (Lippert 2010), and they needed support in managing the interface between their Corporate Social Responsibility (CSR) unit's environmental and the corporation's IT experts, as their environmental knowledge infrastructure needed better maintenance.

Imagine the workers in the company mostly in suits, busy, not all employed directly by the company, but also by a range of consulting firms and other providers of expertise. Within the CSR unit, locate me within the Sustainable Development team, which was not only responsible for environmental accounting, monitoring and reporting, but also for strategic considerations about how the corporation's environmental conduct mitigated or increased the transnational's reputational risks.

My research soon focused on the data practices within their environmental and carbon accounting, as that was something they were most concerned with. I was interested in how carbon data was situationally achieved as well as numerically, textually and visually translated to heterogeneous stakeholders. That accounting infrastructure and its effect still play a role today. It is this infrastructure, rooted in Western countries' 1980s-1990s discourse of ecological modernisation (Hajer 1995), that was repurposed in the early 2000s to allow the company to reflexively engage with the emerging climate discourse. And this infrastructure is employed in today's routinised claims to carbon neutrality.

This focus on carbon accounting intersects with the wider literature on carbon markets in STS and beyond. This literature has well recognised that for these markets to work, various greenhouse gases have to be made "the same" (MacKenzie 2009). While our learning about negative emissions is still unfolding – consider the different politics of making forest or indigenous carbon (Paladino and Fiske 2016; Neale 2023) – little research is available on the production of emissions, positive carbon[4]. We know that for environmental markets to work not only the traded entities (negative carbon), but also the universes in which these entities figure and build relations (e.g., to positive carbon), need to be standardised. Where others have focused on the standardisation of corporate carbon accounting (Lovell and MacKenzie 2011), my material engages with the lived reality of corporate accounting, in which standards do not, unsurprisingly, work deterministically (Lippert 2013).

These analyses build on the wider performativity of economics literature (Callon 1998), which shows that markets are configured in always specific ways. The specific market that my fieldwork relates to is the voluntary carbon market. Addressing with my material the early formation of this market (in the late 2000s) is of interest to critical analysis, because it presents us with an insight into how, without state interference, corporate actors freely and, supposedly rationally, configure themselves as "green" (a form of neoliberal environmentalism, aka ecological modernisation, see Pellizzoni 2011) – where this greenness was in that phase performed

through the grammar of carbon, which could easily be substituted, in the corporate perspective, by other grammars, such as water footprinting or accounting for ecosystem services (Lippert 2015). In that broader sense, my ethnography speaks to STS analyses of metrics, data and accountability in environmental markets (e.g., Asdal 2008; Sullivan 2018; Nost 2022).

The ethnography I conducted can be understood as a discourse or dispositif ethnography (Keller 2019). I lay out, and problematise, the ethnographic apparatus that I enacted for this analysis elsewhere (Lippert 2014; 2020, 306-308). The field was highly dynamic (for instance, a subsidiary with many front-office employees was sold, which effected an increase of the core carbon indicator of emissions per employee), and the accounting apparatus was reconfigured (Lippert 2015). Yet, I observed, too, an inter-organisational governance apparatus (that still is in place) that had effects on the reconfiguration process itself as well as over the transnational's environmental conduct; that governance apparatus involves hegemonic audit firms, a global NGO and practices of "scrutiny" by agencies that produced rankings like the Dow Jones Sustainability Index (Lippert 2014). Now I present anonymised material, selected based on a qualitative data analysis process that explored my corpus of material in relation to time. For this paper, I construct an empirical story, based on that selection of materials, and subsequently analyse it based on the sensibilities sketched above.

4. Achieving Emissions in Time

Inside the transnational's HQ, the head of the Sustainable Development team, Victoria, often provided visitors with the company's Sustainable Development Report, revised each year, to show and explain the team's work. In that document's show of the corporation's emissions, we are presented with a visualisation that captured my eye (reproduced as Figure 1). A serene landscape – enjoy the lakeside mountains, endless nature! – with a textbox overlay. The overlay comes with the headline "Employee footprint" and it further reads "Each employee had a footprint of [*X* thousand] kg in [the year] 200[*y*]. To achieve our [let's say 2015] target, this needs to fall by a further [*z* hundred] kg". At the same time, this artefact's serene landscape appears timeless, visually suggestive of the transnational's carbon footprint as aligning the company with nature – an information of eternal alignment? With these information equipped, I developed an interest in how emission management was coordinated in and with time. The team's objective was to reduce emissions, and for that data about past emissions were needed that could be related to a time horizon, reaching till 2015, the year the emissions were to be sufficiently reduced. And to achieve these reductions, I also learned, the company developed seemingly countless locally designed plans.

In the HQ, one worker who reviewed these plans was the temporary staffer Elise. She was the assistant to the HQ environmental accountant (and the latter's superior was the head, Victoria).

In a phone conversation with me, Elise told me about a problem she encountered while checking the data submitted by subsidiaries for the last reporting year. The case came from the Korean subsidiary. She explained, the Korean environmental bookkeeper had not only reported resource consumption facts to the HQ but also reports of plans to reduce their emissions through particular emission-saving activities. There was something amiss, she made

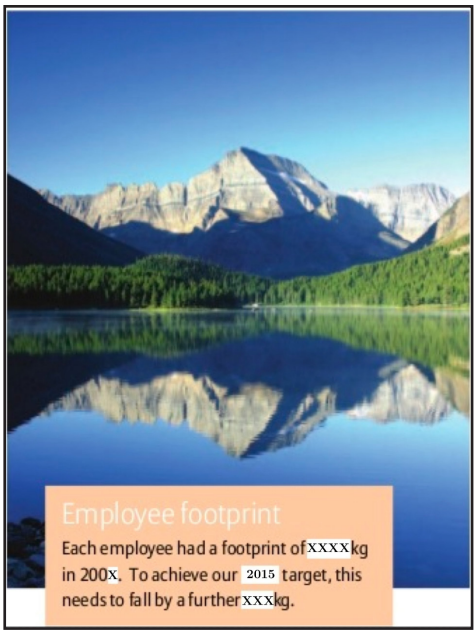
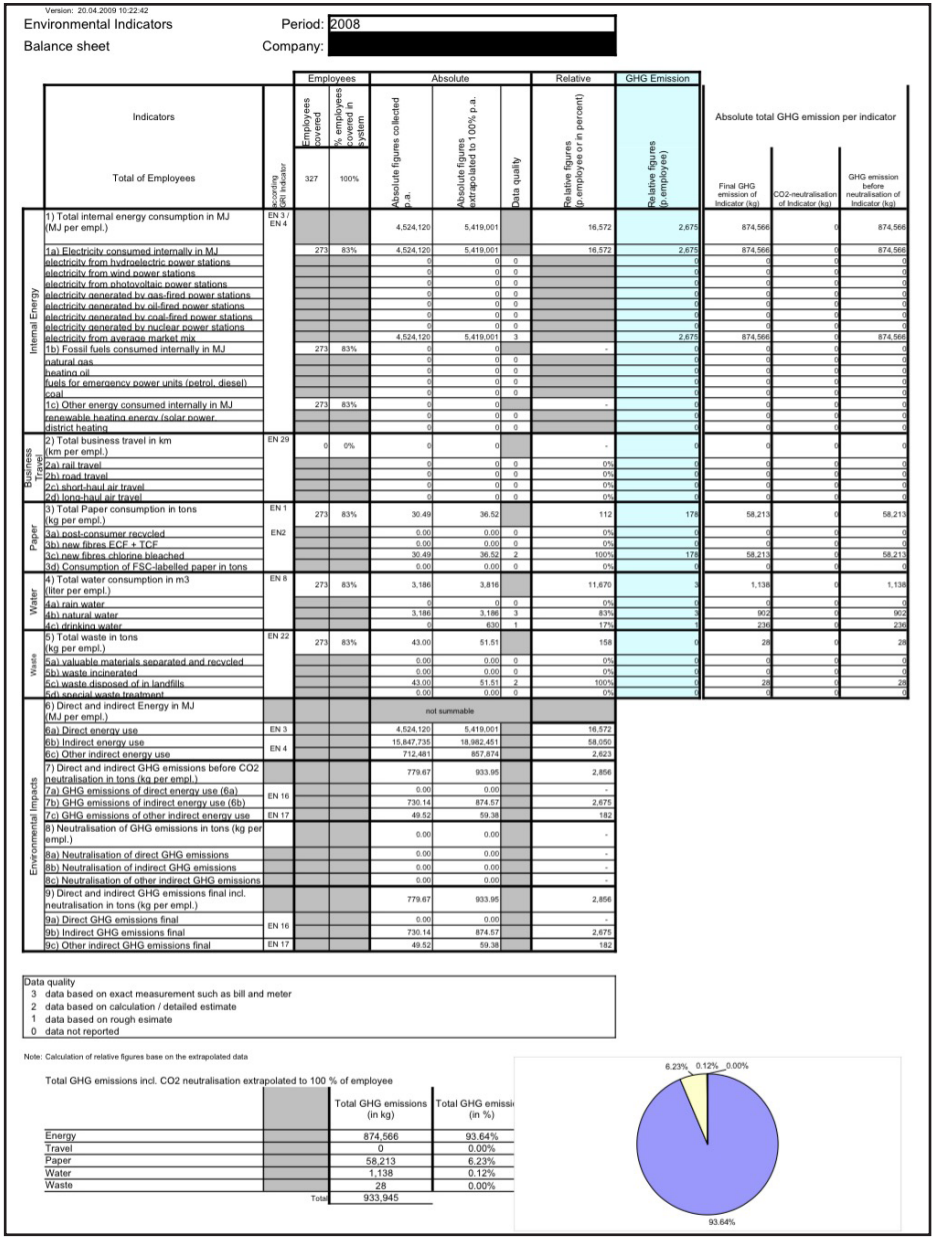


Figure 1.
"Employee footprint", extract from the corporation's Sustainable Development Report (reprinted from Lippert 2013, 206).

clear. "That sucks! Somehow he saves more than he has"[5]. In this interaction, I perceived her as aghast by a physical impossibility, a problem of logic that not only implied the bookkeeper as misunderstanding physics, but also constituted a problem for her, as she had to ask for revisions that would make emissions and reductions fit.

Elise was not only reviewing subsidiaries' reduction plans but also their reports of emissions. For that, she primarily drew on two forms. One was the so-called environmental balance sheet, that summarised all the data reported by a subsidiary for a given year, called reporting period, e.g., for 2008 (see Figure 2). In this spreadsheet, data was highly differentiated, including for instance data about electricity or water consumption or travel data. When I wondered where these balance sheets came from, I was told these are produced by the HQ's Lotus Notes database.

That Lotus Notes database was also providing subsidiary agents with data entry forms (reproduced as Figure 3), which constituted the second type of forms, Elise drew on for her review work. Based on checking and analysing the data reported through the data entry forms, Elise and her superior produced the balance sheets. So, while the data entry forms held the data inputted, the balance sheets presented the intermediate output of the data gathering process; and final emission data were published, e.g., as overlay on picturesque landscapes in brochures for the public.



Version: 20.04.2009 10:22:42

Environmental Indicators Period: 2008

Balance sheet Company: [redacted]

	Indicators	according GRI indicator	Employees		Absolute			Relative	GHG Emission	Absolute total GHG emission per indicator		
	Total of Employees		Employees covered	% employees covered in system	Absolute figures collected p.a.	Absolute figures extrapolated to 100% p.a.	Data quality	Relative figures (p employee or in percent)	Relative figures (p employee)	Final GHG emission of Indicator (kg)	CO2-neutralisation of Indicator (kg)	GHG emission before neutralisation of Indicator (kg)
			327	100%								
Internal Energy	1) Total internal energy consumption in MJ (MJ per empl.)	EN 3 / EN 4			4,524,120	5,419,001		16,572	2,675	874,566	0	874,566
	1a) Electricity consumed internally in MJ		273	83%	4,524,120	5,419,001		16,572	2,675	874,566	0	874,566
	electricity from hydroelectric power stations				0	0	0		0	0	0	0
	electricity from wind power stations				0	0	0		0	0	0	0
	electricity from photovoltaic power stations				0	0	0		0	0	0	0
	electricity generated by gas-fired power stations				0	0	0		0	0	0	0
	electricity generated by oil-fired power stations				0	0	0		0	0	0	0
	electricity generated by coal-fired power stations				0	0	0		0	0	0	0
	electricity generated by nuclear power stations				0	0	0		0	0	0	0
	electricity from average market mix				4,524,120	5,419,001	3		2,675	874,566	0	874,566
	1b) Fossil fuels consumed internally in MJ		273	83%	0	0		-	0	0	0	0
	natural gas				0	0	0		0	0	0	0
	heating oil				0	0	0		0	0	0	0
	fuels for emergency power units (petrol, diesel)				0	0	0		0	0	0	0
	coal				0	0	0		0	0	0	0
	1c) Other energy consumed internally in MJ		273	83%	0	0		-	0	0	0	0
	renewable heating energy (solar power, district heating				0	0	0		0	0	0	0
					0	0	0		0	0	0	0
Business Travel	2) Total business travel in km (km per empl.)	EN 29	0	0%	0	0		-	0	0	0	0
	2a) rail travel				0	0	0	0%	0	0	0	0
	2b) road travel				0	0	0	0%	0	0	0	0
	2c) short-haul air travel				0	0	0	0%	0	0	0	0
	2d) long-haul air travel				0	0	0	0%	0	0	0	0
Paper	3) Total Paper consumption in tons (kg per empl.)	EN 1	273	83%	30.49	36.52		112	178	58,213	0	58,213
	3a) post-consumer recycled	EN2			0.00	0.00	0	0%	0	0	0	0
	3b) new fibres ECF + TCF				0.00	0.00	0	0%	0	0	0	0
	3c) new fibres chlorine bleached				30.49	36.52	2	100%	178	58,213	0	58,213
	3d) Consumption of FSC-labelled paper in tons				0.00	0.00	0	0%	0	0	0	0
Water	4) Total water consumption in m3 (liter per empl.)	EN 8	273	83%	3,186	3,816		11,670	3	1,138	0	1,138
	4a) rain water				0	0	0	0%	0	0	0	0
	4b) natural water				3,186	3,186	3	83%	3	902	0	902
	4c) drinking water				0	630	1	17%	1	236	0	236
Waste	5) Total waste in tons (kg per empl.)	EN 22	273	83%	43.00	51.51		158	0	28	0	28
	5a) valuable materials separated and recycled				0.00	0.00	0	0%	0	0	0	0
	5b) waste incinerated				0.00	0.00	0	0%	0	0	0	0
	5c) waste disposed of in landfills				43.00	51.51	2	100%	0	28	0	28
	5d) special waste treatment				0.00	0.00	0	0%	0	0	0	0
Environmental Impacts	6) Direct and indirect Energy in MJ (MJ per empl.)				not summable							
	6a) Direct energy use	EN 3			4,524,120	5,419,001		16,572				
	6b) Indirect energy use	EN 4			15,847,735	18,982,451		58,050				
	6c) Other indirect energy use				712,481	857,874		2,623				
	7) Direct and indirect GHG emissions before CO2 neutralisation in tons (kg per empl.)				779.67	933.95		2,856				
	7a) GHG emissions of direct energy use (6a)	EN 16			0.00	0.00		-				
	7b) GHG emissions of indirect energy use (6b)				730.14	874.57		2,675				
	7c) GHG emissions of other indirect energy use	EN 17			49.52	59.38		182				
	8) Neutralisation of GHG emissions in tons (kg per empl.)				0.00	0.00		-				
	8a) Neutralisation of direct GHG emissions				0.00	0.00		-				
	8b) Neutralisation of indirect GHG emissions				0.00	0.00		-				
	8c) Neutralisation of other indirect GHG emissions				0.00	0.00		-				
	9) Direct and indirect GHG emissions final incl. neutralisation in tons (kg per empl.)				779.67	933.95		2,856				
	9a) Direct GHG emissions final	EN 16			0.00	0.00		-				
	9b) Indirect GHG emissions final				730.14	874.57		2,675				
	9c) Other indirect GHG emissions final	EN 17			49.52	59.38		182				

Data quality
3 data based on exact measurement such as bill and meter
2 data based on calculation / detailed estimate
1 data based on rough esimate
0 data not reported

Note: Calculation of relative figures base on the extrapolated data

Total GHG emissions incl. CO2 neutralisation extrapolated to 100 % of employee

		Total GHG emissions (in kg)	Total GHG emissi (in %)
Energy		874,566	93.64%
Travel		0	0.00%
Paper		58,213	6.23%
Water		1,138	0.12%
Waste		28	0.00%
	Total	933,945	

Figure 2.
Environmental balance sheet (reprinted from Lippert 2013, 176).

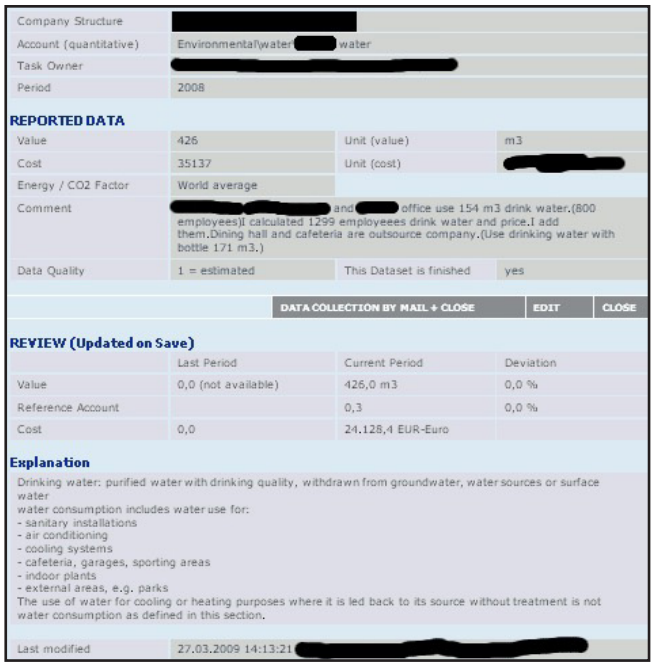


Figure 3.
Data entry form (reprinted from Lippert 2013, 81).

I note that both forms did not only specify the reporting period, but also came with timestamps. At the very top left of the balance sheet, I noted a temporal identifier in small script, "Version: 20.04.2009 10:22:42"; the data entry form employed "Last modified: 27.03.2009 14:13:21".

Here is one such use in which the timestamp mattered: Elise sent to me by email some balance sheets for data testing purposes. Later I had a conversation with her superior. He told me: "Best, bin these". These were old; new ones existed, he made clear.

The timestamp, thus, allowed making a distinction between balance sheets. The same held for the data entry forms and queries on these. Here is another way in which the system's timestamps were productive. Whilst my colleagues focused on analysing subsidiaries' emissions, I was tasked to optimise the central database. One day, Elise called me and reported a problem with the environmental database's data reporting mechanism. I logged onto the system, wanting to scrutinise the reporting query she had initiated, which was indicated by a specific timestamp. I failed. I could not identify a reporting query with that timestamp. Some emails back and forth followed. She sent a screenshot of the query to me. I could not see the query on my interface, although I should have been able to. Here was a situation in which two work processes overlapped: analysing and reporting environmental data (Elise's task) and working towards optimising the information infrastructure (my task). Technically, I was under the impression that I was granted admin rights for the database. But I could not access her query.

As it turned out the problem related to so-called load-balancing. As our company IT department contact explained, a time lag existed between the two servers Elise and I were using; data synchronisation could take several minutes. Data difference was caused by not yet synchronised data between the servers.

Beyond these internal uses of timestamps within the team, we also drew on these when the balance sheets were circulated within the company and beyond. Such circulation of environmental balance sheets took for instance the form of sending the spreadsheets by email to colleagues for approval, up and down the hierarchies; the sheets were printed, even distributed to "external" organisations like rating agencies (imagined as then informing contemporary SRI or ESG indices). Based on some of the feedback, balances would be corrected, updated or in another way revised.

I learned that depending on all kinds of "things" and "concerns" – such as detecting data errors, receiving updated data from other parties, new ground for interpreting the reporting task – subsidiary agents were positioned to update and correct data. That this was not an exception for the system was indicated by the presence and visibility of the timestamp. Data could be more or less old. Any change was reflected in a changed "last modification" date.

The other temporal marker on the spreadsheet and the data entry form was the reporting period. I learned about its significance in a meeting back in January 2009 with the HQ staff. In this, not only was the period printed on the documents, it was also the subject of the conversation. In the meeting the head, Victoria, declared: "after all, this year [2007] ends in one, [or] two, weeks". The reporting period for [2008] starts in February, she added.

When HQ asked subsidiary bookkeepers to fill data in the entry forms, the bookkeepers were supposed to enter facts about consumption that occurred within a particular reporting period. However, the bookkeepers needed time to "collect" data. At the end of a calendar year, the consumption facts were normally not known by bookkeepers; many bookkeepers probably celebrated new year rather than engaging with environmental accounting. The company's environmental managers organised the accounting prescriptions such that the prescriptions allowed the actual reporting to take place during the early weeks of the subsequent calendar year. Thus, after a calendar year, it took some more time until the reporting period closed and bookkeepers were not to report or revise data for the preceding calendar year. And the cutoff point of a reporting period was decided upon in meetings like the one in which Victoria located 2007's temporal position.

For the accounting process it was significant that the reporting periods were well communicated to the bookkeepers. The latter needed to enter all the relevant data till the end of the reporting period. To end the period, HQ accountants increased the period marker by one, e.g., from 2007 to 2008. Hectic weeks were typical surrounding these shifts of the period, as subsidiary bookkeepers had to be reminded of the deadline, and rushed to enter data, while HQ agents reviewed the data they saw coming into the database. Subsidiary bookkeepers had no chance to edit the period field in the data entry form. This prevented bookkeepers from altering data retrospectively. From now on, they could only add and edit data for the "current" period.

This technical configuration constrained the doing of emissions for bookkeepers; however, the period marker could be edited by HQ's database administrators. This was to be a theoretical possibility only. Victoria repeatedly emphasised she wanted environmental data to be in proper, i.e., linear, temporal order. The timing of cutoff points was of importance to ensure that all the required data for a reporting year was in the central database before moving on to the next period.

That these cutoff points mattered significantly I noted in April 2009, when the Brazilian subsidiary contacted us. They asked to "correct [2006] data" because, as they said, "we checked the data [...] and saw that it's totally wrong". However, the database prevented them from editing that prior reporting period's data. Victoria then checked their proposed new data and subsequently wrote to her team:

> [A]s far as I can see, the[ir] numbers deviate significantly from [the prior] numbers. Most of them seem to be more "realistic": thus it is better to take the new numbers, since a better reduction potential can be achieved as well. [...] I [...] urgently ask you to correct the balance sheets and [the database].

That this mattered showed in the numbers. With Figure 4, I visualise the amounts of the 2006 reporting period, before and after the "correction". Quantitively, from the December 2008 account to the mid-April 2009 account, the 2006 carbon footprint increased to ≈ 152 %.

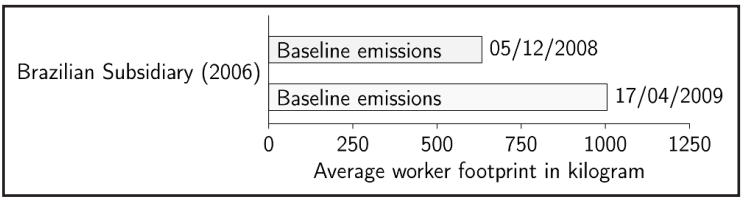


Figure 4.
Baseline year, 2006, emissions of Brazilian subsidiary: date of balance sheet right of bar (revised from Lippert 2013, 230).

Such changes as well as the causes for these changes, required the HQ team to engage with many details, costing too many hours. For this, and related reasons, the team joined forces with other units of the transnational to switch the entire environmental data gathering and processing system from its Lotus Notes base to a seemingly more promising SAP system. In fact, my work consisted very much of supporting this transition process. In one of my final conversations in the field, meeting in a café, I chatted with Elise about her work process and her worries in this transition. She told me that she was asked to manually transfer data from the Lotus Notes database into the SAP system. And, she told me, an automatised data transfer had been possible – but was not wanted. She had to manually transfer data to check the quality of the prior reporting periods' data and, if necessary, adjust that data. Soon afterwards, the corporation had managed to reach its publicly declared emission reduction target – even before the targeted year.

A scandal? Is this an exception, or routine, I wondered. Is it normal that past emissions are set and unset, written and rewritten, over time, are past emission realities simply forgotten?

5. Timescape of Corporate Carbon Accounting

My empirically grounded story shows the mundane practices and infrastructure involved in corporate carbon accounting, as required for a "successful" capitalist corporation's sustainability management, which operationalises its "discursive" relation to climate change (Lippert 2011a). Here I re-narrate the story to foreground the complex temporal politics at work within the discursive production of emissions as accountable entities.

The visualisation from the Sustainable Development report, see Figure 1, provides us with a surface impression of the complexity of corporate carbon. Immediately, the report's reader finds a seemingly untouched Nature, which can be read as evoking environmentalism and concern about climate change, that is related to corporate emissions and to the corporation's staff[5]. This illustrates the shift from questions of Nature to the managerial take on carbon. For the company's managerial approach, key is change, implying they consider their emissions in relation to time; the corporation is normatively orienting itself by way of time, for over time the emissions are to be reduced. In the textbox, we find reference to the most recent footprint, a past that changes each year, and to a target year (future). Implicit is the baseline, a foundational past, enabling the calculation. This visualisation, therewith, presents us with a quite straightforward chronologically organised timescape, in which reader and corporate emissions are positioned between baseline and target. However, this chronological order is juxtaposed with an untouched, endless Nature, a horizon of eternal beauty. I argue, this visualisation presents a version of carbon, saturated with temporal relations, that is only the tip of the complex temporal politics invested into the making of the figures inscribed within the report.

5.1 Carbon Figures and Their Temporal Orders

The yearly reports were the public and rhythmicised product of the team's effort in environmental reporting for the transnational. For this reporting, they operationalised a reporting period, which appeared all over, dominantly as inscription on both, balance sheets and data entry forms. In this way, carbon figures produced were always tied to a reporting period. I analyse this period as coming with an inner and an outer temporality.

Inside, a cyclic temporality was organising the activities of the team. Year after year, in each reporting period, a management cycle effected a rhythmicity like seasons: data collection was followed by data analysis, followed by reporting, planning emission reductions and then, ideally, by reducing emissions; then the cycle would start anew with collecting data. Even though this summary of the cycle is highly idealistic, it indicates the diachronic character of generating carbon inscriptions: over time, positive emissions are accumulating and are to be reduced (planning for negative emissions); it takes time, many hours and months, to account for both the positive and negative emissions.

Outside, periods were imagined as following one another in a linear temporal order. While the period was typically designated like a year, the reporting period existed alike a fiscal year. The period 2009 could last from, say, February 2009 to January 2010. In that period (e.g., till end of January 2010), bookkeepers were to enter consumption data of 2009, and after the period's end, the team and others could compute and review emissions, ask for corrections,

etc., and compile a report for 2009 in spring 2010. Victoria's declaration that "after all, this year ends in one, two, weeks" refers to such a reporting period, uttered in the phase before a shift of period. The movement from one period to the next established another diachronic process that was in principle independent from chronological time.

We find traces of both diachronic processes across my story, for instance in the process of circulating balance sheets for review across the company in the weeks before a report got finalised (within the period's management cycle) or in Victoria's positioning of the shift from one period to the next within chronological time. However, the story also shows that carbon was taking form in ways that crossed the boundaries of the circle, and effecting disorder in the linear sequence of periods (case of setting the reporting period back to 2006, say in April 2010, allowing to revise earlier years' carbon figures, as in the case of the Brazilian subsidiary). Such disruptions of the expected frames happened too often from the HQ's perspective. In literature, the temporal maelstrom within management is well recognised (Adam et al. 2002). With Callon (1998) we can address these phenomena of carbon figures not fitting in as overflows. Therewith I highlight that emissions are unsettled and (re)set within and across the framework of periods.

To allow the members engaged in this accounting work to not lose track of emission figures, emissions came with timestamps, that located emissions diachronically, too, within chronological time, here seemingly proper Newtonian, as postulate-able with Adam (1998). Elise and I used timestamps to identify emission reporting queries, Elise's superior used timestamps to discern between older and more recent balance sheets. In that sense, timestamps took on the role of reflecting when, in chronological time, a carbon figure was created or modified, and this powered coordinating the readers of these timestamps. In that sense, the timestamps were meant to serve as metadata, attached to carbon, but not part of carbon.

The timestamps came with a specific format, owning to a specific history: the company had once employed a German environmental accountant. And in Germany, dates are formatted as [Day.Month.Year(after the beginning of the Christian temporal world order)]. Both particular dates (27.03.2009 and 20.04.2009) were probably well understandable even for users who would have expected a [Month.Day.Year] notation – served by the contingent fact that the day count was larger than twelve. I find, to read time, the user had to be equipped with particular understandings. Temporal identification thus was not universally defined but contextual and relative. The reader had to learn how to read this notation of carbon figures correctly. This resonates not only with Star and Ruhleder's (1996) point that membership within infrastructure needs to be achieved, but also with the politics of notations and calendars (Joerges 2003). A carbon figure thus was necessarily also involving an interpreter, human or otherwise, who would be equipped with the resources that enabled them to locate carbon in time.

However, as the diachronic process description also indicates, not only were interpreters prompted to locate carbon figures in the chronological order of time, also the conditions of enactment shaped what kind of carbon figure turned into reality. This is an ontological point. Consider for instance Elise's superior who used the timestamp as a guide to shape which carbon would circulate. The temporally situated figures of interpreters, of carbon data points, of notations (and more elements) were put in relation to each other, effecting carbon as consisting of several figures, assembled in a specific way. Carbon emerges as configured. In carbon as a configuration, time is not only metadata, but it becomes part of the configuration, effecting a complex carbon figure.

The episode in which Elise and I engaged with the reporting queries indicates a further way in which the timescape of carbon required active and machine-supported attention. Whilst members typically proceeded within their diachronic process, Elise and I stumbled upon the issue of asynchronicity. As became clear, the synchronicity of carbon figures was not given, but needed to be achieved. That was, because the carbon figures did not exist singularly at one place but where distributed across servers located in different buildings. And, resonating with Mol's (2002) analyses of the different enactments of atherosclerosis in different wings of a hospital, carbon, located within different servers or otherwise different situations, can be enacted differently[7]. The work of synchronisation consisted of distributing these different computational enactments to specific time-places, thereby rendering locally existing versions outdated, regularly overwriting prior carbon realities.

The infrastructure to produce carbon figures, thus, involved several forms of time: it consists of a diachronic process as well as a/synchronic moments; time is outside of carbon figures as metadata, and it is folded into the situated enactment of carbon; beyond the chronological order of time, carbon figures took, and were given, form, too, through reporting periods that were on their outside nominally ordered linearly but practically could sidestep the sequential chronology, a form of disorder; whilst inside, the work across a period was structured cyclically, yet, again with overflows. With Vostal et al. (2019) the role of the human agent in this infrastructure can be addressed as engaging in "agentic synchronization". They develop this concept to point to scientists' capacities to deal with experiments' various temporalities, achieving to synchronise the latter. In my story, the corporate employees figure as agential figures within carbon – navigating, placing and altering as what, where and when carbon becomes synchronically configured.

5.2 Configuring Carbon Well?

The configuration of carbon was not only dependent on machinic factors and on humans who have shaped these machines. Carbon, I argue, was also configured quite directly by humans and their expectations of what carbon is in relation to time. Consider the case of Elise problematising the Korean plans of reducing their carbon footprint. She considered the Korean account of their emissions saving plan problematic, because the subsidiary made plans to reduce emissions by more carbon dioxide equivalents (CO_2e) than they emitted. The problem, specifically, were neither the emission saving plans per se, nor their amount, but their timing. Whilst Elise and her colleagues would be able to position emissions (i.e., positive carbon) and emission reduction action (i.e., negative carbon) on a chronological timeline, this case shows that where on such a line negative carbon was to be located depended on some normative logic of when these negative emissions ought to take place. In other words, for Elise, proper carbon included a sequential structure in which a certain amount of emissions could be subsequently reduced rather than preceded by emissions reductions. Her comment suggests that planned emission reductions had to be timed well. This opportune time for negative carbon differs from chronological time. Time studies suggest the Greek concept *kairós* to refer to the opportune time for some action (Cipriani 2013); and here Elise evokes implicitly such kairotic time.

I noted, too, that for the team that handled emissions, retrospective changes of past emissions, whilst possible, were ritually detested. Again, in the configuration of carbon, I find the prescription of better and worse timings for certain treatments of emissions. Members

repeatedly confirmed that emissions that were several years old, ought not be touched. The instance of Victoria having to elaborate her reasoning to change the old Brazilian emissions illustrates the exceptional character of such changes.

These two traces of structuring carbon not only chronologically but also kairotically, afford zooming out and differentiating these practices' commitments. I suggest that team members could situationally perform, and choose from, three archetypical mentalities of carbon accounting. Each mentality comes with a different understanding of how emission reductions should be timed. First, an environmentalist mentality would want to maximise any means to reduce emissions or to create emission sinks. I consider this environmentalist mentality as coming with a realist epistemology: real emissions and effects of reduction instruments on the real footprint are actually measurable. Second, an accounting mentality can refrain from addressing this as a question of "real" emissions or emission reductions "out there". Accounting can take a constructivist stance. What counts is what the book states (Lukka 1990). Third, the business mentality asks how emission reduction can be aligned toward sustaining the business. In short, if the subsidiary employs all greening measures this year then in future years, they won't be able to tell success stories (Lippert 2011b). It makes business sense to delay emission reduction measures for future green progress narratives.

Elise modalised the Korean subsidiary's emission reduction plans as missing something, indicating that something was not correct. What was that something? Given that Elise's job entailed coming across various deviances from explicit reporting norms (an, unfortunately, ordinary experience for her), which she would then routinely process towards rectification, in this situation that "something" was extraordinary. Also it was the role of Elise's superior and Victoria to enact the business mentality. Elise considered that something so extraordinary that she modalised it, called out, in a vulgar manner, that it was really bad, a deep violation. That something was the plan to "sav[e] more" emissions than they had emitted – a question of sequence. I read this combination of modalisation and sequence description as indicating the realist mentality: specifically, Elise suggested that it is not correct when the amount of emissions saved exceeds the positive emissions of the subsidiary. I suggest that her problem only existed because of the kairotic ordering of the actions of emissions reduction and production.

The case of Elise's realist problematisation of the Korean subsidiary's plans indicates a commitment to real linear time, a timeline on which emissions and their reductions are sequentially ordered. However, I shall show next, this realist mentality does not entirely dominate the carbon accounting timescape.

The case of Victoria's engagement with the Brazilian data is noteworthy because of its immediate consequence for the management approach that presumes a baseline. Baselines are typically assumed to be stable and reliable grounds against which later measurements are compared. Ureta et al. (2020) underline that baselines come into existence through the practice of baselining. This literature resonates with my analysis that carbon is enacted, and that various versions of carbon can exist in parallel, calling for ongoing agential synchronisation. This also means that the baseline can be multiple; and in the case under discussion, Victoria conducts work of baselining, rebasing, that is making one baseline win over another.

Ontological multiplicity in baselines implies, furthermore, that baselines are not simply effects of a specific baselined entity, but also of the time of baselining. Baselines are situation-

ally configured. The difference in Figure 4 was possible precisely because the accounts were not accounts *of*, but *for* emissions "out there"; the accounts were accounts *of*, i.e., produced with and in, the reporting infrastructure. And the two versions of carbon were enacted in two differing configurations of and within that infrastructure.

The baseline increase to ≈ 152 % had economic implications. If later, say 2015, emission data was not changed, the higher the baseline year's emissions were, the easier was it to reach the reduction target. Within the relational configuration of baseline(d) entities, a consequence of the multiplication of baselines can be the legitimisation of shifting targets, that is shifts of the targeted reality. A critical analysis of the effects of so-called digitalisation on environmental relations might consider such legitimisation highly concerning, underwriting the illusive character of hegemonic promissory discourses of sustainable development and ecological modernisation (Lippert 2022), but here I focus on how understanding the consequence of shifting targets allows a deeper understanding of the temporalities involved.

Organisationally, this consequence was hidden behind the overarching norm of arranging periods externally in a linear temporal order and behind occasional practical reasons interfering with this norm. Practical reasons varied; a predominant reason was that a subsidiary declared having now learned that old data included errors. This simple declaration matters. First, this declaration implies a story about repairing errors. In the past reporting was faulty and, luckily, that error was now recognised and, therefore, should now be repaired. Second, this is a story about cyclic learning. Corporate environmental management systems are, after all, all about helping the company to learn about its environmental impacts and learning to improve its environmental performance. That is at the core of the management cycle I described as performed across a reporting period. Across that period, slowly, the company learns about its emissions, and as part of that, to know their emissions better, accountants check data for plausibility (and ensure data corrections).

I posit, too, a broader infrastructural cycle that operates at a slower pace than the year-to-year learning cycle of the environmental management system. The infrastructural cycle is shaped by the IT infrastructure and database renewal pattern. Storage systems, including metadata standards and database configurations are subject to change. Elise's account of the switch from the Lotus Notes to the SAP database indicates that such changes afforded another opportunity for learning, including legitimising corrections. Before data would be transferred to the new IT infrastructure, the data would be reviewed, cleaned, to ensure the new setup would start with a freshly tuned base for further data collection.

These cyclic temporalities were part of the temporal infrastructure of doing emissions. Within each cycle data was not stable; each data point was in principle, and often practically, replaceable. But also outside of the cycle, data could be easily replaced by better data. In a database, thus, each data point was subject to potential and often actual modification, adjustment, update, repair. To think about this character we can draw on the notion *placeholder* as Riles (2010) uses it. With this notion, we are able to grasp a key part of the quality of carbon statements. Like a legal fiction, carbon emissions are created to *overlook* them. A legal fiction is a way of legal technicians to make an assumption about a certain status of which all participants know that it is merely an assumption and, thus, its truth value is not of interest. I like to argue that carbon emissions statements have a similar status. Riles (2010, 803) defines placeholder in this way:

> [T]he placeholder's central feature is that it forecloses the question of the moment for the near future, not by resolving it, but by papering over it, we might say, by creating a dummy solution subject to future reevaluation. [Thus, the] placeholder is a tool of forgetting, of putting to one side.

Every data has a future – a future of being looked at, overlooked or changed. Each moment of looking is also a possibility to overlook and to not change. What the data is, is not as relevant as that there is data. The accountants would never deny the possibility that they learn better; no account is complete; the data is always subject to change. But each data is also always available for near future action, to be read again, to be present, to re-configure the body of the corporation's environmental knowledge.

6. How a Neoliberal Timescape Allows Forgetting about Carbon

Social sciences and humanities have underlined the role of corporations and capitalism in causing the Anthropocene including climate chaos. For an analysis of the infrastructures of timescapes of the Anthropocene and climate change, I turned to a transnational corporation. The way this corporation has engaged with climate change was not directly caused by climate legislation but can be presumed to be an effect of, as it were, "free" market relations, thus allowing insight into practice under conditions of self-interested corporate behaviour, that is under neoliberal governance. This paper specifically addresses how carbon accounting was infrastructured, and how, in effect, carbon was shaped, with a focus on the way time figured in carbon practice.

Ethnographically, I showed a complex timescape characterising not only the outside of carbon but also folded into carbon as a figure itself. Inside carbon, we find troubles within several diachronic processes as well as in achieving the synchronisation of carbon. I indicated how carbon was ideated as well as structured in an ordered repetition of cycles within which carbon figures were to be produced and released into public communication. However, I showed instances of overflows, where the order within and across cycles was interrupted, effecting the legitimisation of not only shifting baselines but also of shifting targets – constituting disorder. Competing mentalities operate within the corporation, where some logics seek to enact realist understandings of emissions mobilising kairotic time and other logics seek managerial optimisation of emissions that, as it were, luckily, are also in the companies' interest. Easily, in this temporal complexity, emission reductions, including carbon neutrality, can be conjured up.

The corporation engaged in an ontological politics of when. This means that the corporation did not only exploit the possibilities of the multiplicity of carbon as a datascape to generate specific emissions for the current reporting period (Lippert 2015), also the corporation achieved to locate these carbon figures at will across time. The amounts of emissions of a specific reporting period are flexibilised through this politics of when. For the company it matters that the baseline exists; the amount of emissions at the baselined reporting period is subject to strategic practice. This finding does not only resonate with Adam's (1998, 40) consideration that "everything is present now", in my case meaning that pasts and futures are folded into carbon in present practices of configuring carbon. It also resonates with Riles's

(2010) work on placeholders insofar as the baseline setting was not as important as that there was a baseline. The carbon accounting infrastructure of this corporation was configured as a tool for forgetting about emissions. Not only did the corporation operate and optimise the infrastructure in a way that allowed rewriting carbon figures, but the contingent nature of carbon figures allowed to then forget about carbon, as, effectively, this corporation showcases how it can achieve conjuring carbon neutrality whilst not threatening its superb capitalist performance. With its carbon "machinery", it allowed itself to forget about carbon.

Critically I could end this in terms of the systemic message that greening companies via carbon governance can sustain the unsustainable, as Blühdorn (2007) called it. However, I propose a problematisation that pays attention to the corporation's achievement of carbon as a sufficiently flexible figuration. This flexibility is not so much characterised by an industrial, Newtonian, time, but much more by the strategic temporal politics at work, effecting then not an industrial timescape, but a neoliberal timescape. Pellizzoni (2011) characterises the nature of neoliberalism as governing through flexibility and disorder. Corporate carbon accounting thrives on two significant forms of disorder: shifting baselines for measuring emission reductions and shifting targets for these reductions. My analysis foregrounds how the neoliberal timescape powers forgetting about environmental concerns as these become routinised and substitutable signs.

Forward-looking, I suggest that STS contributes to analysing capacities of human agents, whether staff or activists, engaged in the infrastructures of environmental governance, to reconfigure the environments they engage in. For that I suggest borrowing from STS accounts attending to workers in other domains – consider Suchman's (2012) work on healthcare workers or Dányi and Csák's (2021) work on social workers – which underline agents' diverse forms of highly relevant knowledges that are most apt to inform intervention in and governance of their respective domains. Let us seek out those with capacities to trouble neoliberal timescapes that sustain climate chaos.

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Notes

[1] In a nutshell, the Kyoto protocol, "implementing" the United Nations Framework Convention on Climate Change distinguishes between two groups of countries; the first group committed to reducing emissions, which they could achieve domestically but also using "flexible mechanisms" such as emissions trading, e.g., via the Clean Development Mechanism (see Ninan 2011).

[2] In critical social movement studies, a neoliberal timescape is proposed as differing from the industrial (Gillan 2018).

[3] The hyphon in con-* serves to emphasise its meaning as a prefix co/-con-/com- that refers to the joint achievement of its effects. In that sense, the formulation co-configuration is tautological and not necessary.

[4] A notable exception with focus on positive carbon is Ubbesen's (2015) work on the Danish national greenhouse inventories.

[5] Elsewhere I translated Elise's colloquial vulgar expression as "That bites" (Lippert 2013, 496), but in hindsight, "sucks" seems to be a more apt translation.

[6] And, of course, readers who hire, fire or experience a part time position, can imagine how difficult it is to count employees (see also Lippert 2013, 185-193); the untouched Nature could be analysed critically, too, in terms of not showing the imprint of anthropos on nature.

[7] I analyse such enactments elsewhere in terms of multiplicity (Lippert 2015).

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