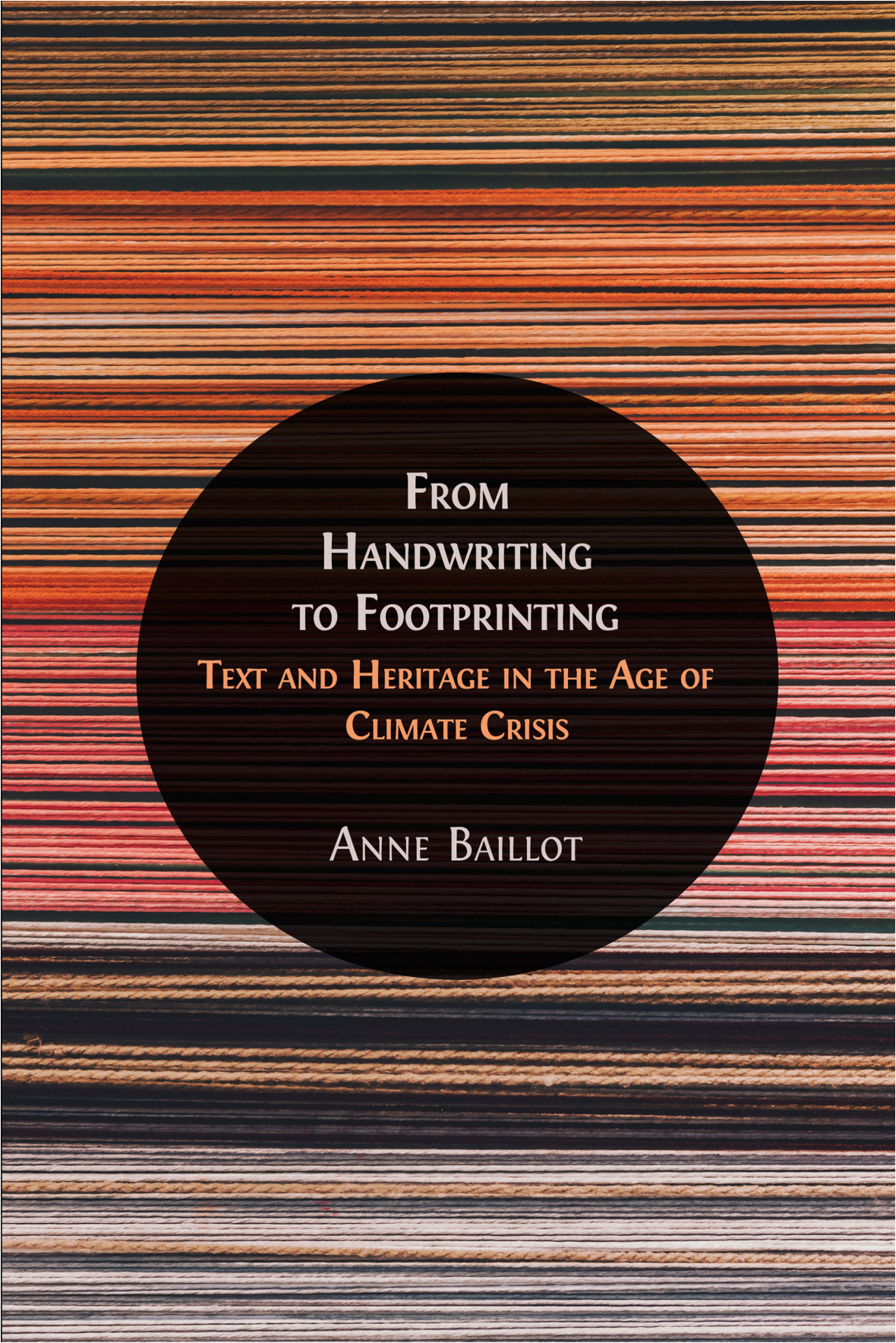
From
Handwriting
to Footprinting
Text and Heritage in the Age of
Climate Crisis
Anne Baillot

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3. What the climate crisis does to text

Several shifts in access to text are made possible by digital technologies. Many of them have the potential to improve curation and distribution dramatically. They make large quantities of text available, including text that is relevant for cultural heritage. Monitoring choices made by major providers of digitised text worldwide is still an issue in several regards, among others in terms of technical choices, such as formats, ethical premises, and selection mechanisms. Nevertheless, quality criteria are being developed, and are more widely acknowledged by the day.[1] Quality insurance remains a challenge, but with the development of communities of practice dedicated to improving it, it has become possible to work towards constructing digital resources that will be accessible to anyone from anywhere in a good text quality. And perhaps more importantly, if the goal is to grant access to text in general, digital tools offer the possibility of considering material objects and their digital surrogates as a whole, and to empower a variety of actors to take part in the curation of them at different levels, connecting analog and digital worlds. Digital information can be conceived, organised, and modelled in such a way as to circulate between institutions: there is a much greater permeability in the process of information curation addressing different versions or representations[2] of the same digital and/or physical document.

Admittedly, understanding how information circulation operates is not as intuitive as simply clicking around on the internet. And it remains a major challenge to include digital complexity in training schemes. Current educational structures are in most cases overwhelmed by the implementation of the pedagogical material and settings that are necessary

1 Funders are playing a key role in leveraging towards empowering Open Science practices. Mandatory requirements condition grant approvals at European or national level in Europe. This is often criticised, in particular by social science and humanities scholars (these reproaches are evoked in Baillot and Giovacchini *TEI Models* [16]), but applying a minimal set of good practices inevitably requires the surrender of some privileges.

2 See 2.2.1.

 https://doi.org/10.11647/OBP.0355.03

to achieve a degree of data literacy to enable a wide array of people to grasp the potentials of what is open to them.

This scale of quantity, quality, circulation, and complexity comes at a social cost: not everyone is able to gain orientation in the digital world. It comes at an economic cost: major companies dominate the market, which also means, considering how they achieve their grip on society, that it comes at a cost for our private lives too. These are all aspects worth looking into, which have been addressed critically over the past years — yet stayed unresolved overall.

Until very recently, little attention was paid to the fact that they also come at a considerable environmental cost. In this final chapter, I want to engage in a reflection on this specific dimension and provide some orientation on the environmental footprint of access to both physical and digital text. My goal is not to negate the idea of a free and open access to knowledge and culture for what north-western societies would like to consider as "the masses", simply because it does not fulfil all of its democratic promises. The following considerations strive to envision tomorrow's preservation, recording, and dissemination strategies for textual content in a context of greater respect for the limited natural resources that are at our disposal. It tempers the ideal of universal access, but by no means intends to terminate it.

My argument for the greater respect of environmental issues is not a speculative one. On the contrary, it is anchored in the materiality of textuality. It could be objected that the digitisation of cultural heritage is, in the context of the big picture of the climate crisis, as good as irrelevant. The carbon footprint involved by the digitisation of cultural items has never been considered a key area to tackle, and it is clear that we are not going to save mankind solely by optimising the way in which access is provided to textual heritage. But I would like to show how access to text is strongly rooted in an overall system that can be transformed for the better. Technical solutions and the intellectual grasp of the mechanisms at work can be used to transform the changes brought about by digital opportunities into less damaging ones.

In the first section, I present general issues and challenges related to the environmental impact of access to text; in the second, I elaborate on a concrete example, focusing on the environmental footprint of the book you are currently reading, composed with the help of the publisher, Open

Book Publishers. The self-reflective process initiated in the final section is conceived as a tribute to an editorial tradition that paved the way for a dialogue on convergences of interests between actors concerned with the transmission of culture and knowledge at large.

3.1 The environmental cost of access to text

There are several ways to envision, and ultimately measure, the ecological harm generated by human activity. Greenhouse gases — mainly carbon emissions — are generally in the main focus when it comes to measuring negative impact. It is a valid indicator in the sense that it gives a compelling idea of the magnitude of destruction we have to deal with.

Emissions are a slightly different calculation than footprint. Footprint includes not only local emissions, but also the greenhouse gas output that is produced by the imported goods in use in a region.[3] In a western country, annual per capita greenhouse gas emissions are evaluated at around 5T as I write,[4] while their footprint is 10T when all the products imported from other countries that are consumed or used in the country concerned are included. Both emissions and footprint concern only greenhouse gas, but there is much more than carbon to take into account when it comes to assessing overall environmental impact. But it is more complicated to measure impact on biodiversity or on water resources. General discourse usually focuses on greenhouse gas emissions.

The environmental cost I shed light on in the following pages strives to encompass all dimensions of human impact on natural resources, even if they are not precisely measurable. My goal is to frame the question of access to text and of archiving textual traces in an epistemological context so that it can be redefined, based on the premise that we do not dispose of infinitely available resources. In that sense, I am moving back to theoretical approaches developed in chapter 1, in which I followed

3 The Intergovernmental Panel on Climate Change (IPCC) has set up a Task Force dedicated to National Greenhouse Gas Inventories that regularly publishes reports; see `https://www.ipcc-nggip.iges.or.jp/`. For entities such as organisations or territories, tools have been developed to calculate GHG; see, for instance, the *Bilan Carbone* tool: `https://bilans-ges.ademe.fr/en/accueil/contenu/index/page/calculation_methods/siGras/0`.

4 For France see here: `https://www.worldometers.info/co2-emissions/france-co2-emissions/`. My sources in the following discussion will be focused on France and Europe, where Open Data regulations favour the publication of data and tools.

Derrida's and Ricoeur's arguments that considering what we do not have is essential for us to deal with what we have.

The first section reviews the different forms of access to text I have presented until now and lists the environmentally harmful items they involve. I then move to the ways to improve the *status quo* that can be envisioned in order to maintain a text production, preservation, and consumption activity while reducing its overall footprint. The last section proceeds to an assessment of the emitting factors in the production and use of this book, trying to identify strategies and ways to engage with them more widely.

3.1.1 Assessing the environmental footprint of text

Defining quality digital text, as I have shown in section 2.2.2, is not as intuitive as it may seem, even to those who are used to browsing the internet for textual content. But quality criteria now exist. They make a wide access possible and, with that, a renewal in the approach of text, cultural heritage, and preservation strategies. People from the other end of the planet do not need to travel to archives or libraries anymore to consult a manuscript or a book; they can simply browse a catalogue on the internet, find the link to a scan and consult it. Maybe they can even zoom in on the scan and reach a legibility that might prove to be better than consulting the original manuscript. And maybe they can click, from this scan to, for example, an encyclopaedia, via metadata, and gain additional information. They can run automated text recognition software on the image, supply text and annotation, and gain new browsing options. Everybody can benefit from this.

Or so it seems. Upon closer inspection, this perspective restricts access to cultural heritage in many ways, even when the heritage concerned is simple text and not a complex reconstructed 3D artefact. In order to access, for instance, a reliable digital scholarly edition that provides scans of a manuscript, a critical apparatus commenting on it, and links to further resources, a user will need a good end device, whether personal computer, laptop or tablet, electricity, and bandwidth — all things that only well-resourced countries can provide widely. The dream of giving access to text to everyone is fulfilling Enlightenment ideals so well that it is precisely what it is realising: a liberal *Weltanschauung* agenda for European and North American intellectuals.

The type of access that can be fostered along the lines of what I have been sketching throughout this book is access for the rich. While modern societies have advanced technology to the point that they can convince themselves that it is financially accessible to the masses, I would object that they have not really done so. Although the economic cost has been lowered (occasionally requiring strong political measures) and has become acceptable for a wider array of the population, the environmental cost has risen to the unacceptable for the vast majority, if not for all. Considering environmental cost means trying to shift perspectives from a northern-western point of view to a global one too. Who has access to what exactly, and at what cost?

This question has been haunting me since the moment I realised the potential contradiction entailed in Open Access. I had worked for ten years towards providing a freely accessible, scholarly reliable, reusable digital edition of a variety of manuscripts that, with its choice of texts, strove to address shifts in the literary canon.[5] But providing access to high-resolution scans of manuscripts 24 hours a day, 7 days a week, would not really facilitate much for colleagues from less resourced countries, let alone for a wider audience, because many of the underlying technologies are too complex to be implemented on older computers with a poor internet connection. Not only was my edition not really accessible to these users: it probably contributed to making their lives poorer, since the energy required for high resolution scans, animations, and coloured banners is adding environmental impact for a limited informational benefit. In the bigger picture, it leads or will eventually lead to restrictions on their side — electricity shortages, degradation of infrastructures, and more. The technologies I had been using relied on the idea that it was perfectly sensible to use resources (in some respects, a lot of them) in order to make what I considered a better text available. In a way, my use of digital solutions led me to push the boundaries, perhaps even to ignore to some extent the unavoidable tension of having to make choices, of having to define limits to preservation, of accepting that resources, room, and time are finite.

5 See my digital edition *Letters and Texts*, `https://www.berliner-intellektuelle.eu/?en`. Older versions can be consulted via the Wayback Machine at `https://web.archive.org/web/20220000000000*/https://www.berliner-intellektuelle.eu/?en`. The current version can be consulted at `https://discholed.huma-num.fr/exist/apps/discholed/index.html?collection=bi`.

Defining a course of action based on this observation is not simple. If you try to delineate more precisely the elements that are energy-intensive and that should hence be either banished or at least reduced to a minimum when it comes to digital access to text, you need to analyse every step in their conception, production, and dissemination. In the following discussion, I will go through this kind of overall assessment by looking into three major types of access to text: archiving, publishing, and digital editing. For each of them, I will list the elements that need to be taken into account to assess their environmental impact based on what is hosted, how it is hosted, and how the hosted material is being accessed. My goal is to shed light on the way these elements are embedded in socio-economic mechanisms at large.

Let us begin with archives. Archives are the oldest institution I have mentioned in this book. They have adapted over time to modern requirements while staying true to their original mission.[6] In today's configuration, archives still need to provide a room that is fit for the preservation of paper documents: a room kept at an even, suitable temperature that protects them from heat, cold, humidity, rodents, and other causes of decay. Ideally, the building would be conceived for that purpose and equipped accordingly. Some of the recent archives (or, for that matter, libraries), have chosen to keep their stock underground:[7] this optimises avoiding light and keeping temperature rather low, although it makes things more complicated as regards to the humidity level. The storage room needs to be equipped with shelves, boxes, and a temperature monitoring and controlling system, equipment that has to be produced and installed. It also needs constant support once installed: at least one person has to supervise the physical conditions for preservation and the machines that monitor them. It can happen that any part of the system (heating, cooling, or control) becomes deficient, and then technical support is necessary. This means having yet another person work on the physical preservation conditions. Additionally, an archive will need recording and consultation infrastructure and personnel: for this it requires a room where people can undertake recording and consultation that will be different from the storage room, since the storage room will most likely be cold and windowless, and its optimal conditions are in any event easier to maintain

6 See Pataki-Hundt, *Bestandserhaltung* [85].

7 The most prominent example is certainly the Bodleian Library in Oxford. See Legg, *Underground* [75].

if not aggravated by human presence. All in all, the bare minimum for an archive is two rooms and one skilled and trained person to monitor preservation, recording, and consultation.[8] As recording happens in a digital format nowadays, a basic IT infrastructure is also needed, even for an archive that does not provide documents in a digital format for online consultation. I should add the transportation that takes place when documents are brought to the archive, when staff comes to work, and when users visit to consult documents.

A larger archive will not only have more rooms and more personnel; it will have a much larger IT infrastructure for hosting digital material such as scans of manuscripts. It will very likely also have scanning capacity and server space. This means that a third room will be necessary, one for servers, requiring yet other temperature and humidity conditions, involving skills to be maintained, and additional energy to actually function. What is more, this digital infrastructure is highly likely to be mirrored — duplicated for preservation purposes. The various files will be regularly copied in a datacentre somewhere else in case the actual server stops functioning. This requires yet more resources, this time for maintaining the datacentre and for regularly sending information updates to them.

In terms of environmental cost, each of these elements (personnel, building, transportation, IT infrastructure) has an impact,[9] which depends on the way in which it is being implemented. I have not even accounted for the ecological impact generated by the production of paper and ink in this scenario because the quantities available in an archive are limited and are relatively stable over time. But things are different in that regard when it comes to the second type of access to text, publication.

In the case of the environmental weight of publishing houses, some features are similar to that of an archive: they require storage room, with less strict temperature conditions than for manuscripts, but larger storage rooms to store all printed copies of at least one, more likely several books at the same time, more personnel to monitor the production workflow

8 In the UK, the National Archives have drafted specifications for the assessment of the environmental impact of buildings and operations, see `https://www.nationalarchives.gov.uk/archives-sector/advice-and-guidance/running-your-organisation/assessing-environmental-impact/`.

9 At country level, greenhouse gas emissions by sector are presented and actualised by the European Environment Agency here: `https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer`.

than in an archive, and, as we will see, even more transportation and IT infrastructure. But it requires, additionally, a substantial amount of natural as well as chemical resources for producing paper and ink, and machines for at least printing, binding, and packaging.

Taking textual production from the very beginning, I will consider a contemporary author writing a text. They would probably sketch some of the first ideas and drafts in actual, handwritten notebooks, but then move to a computer-based text. This work step would involve: one computer, ink, and paper, even before the text has left the hands of its creator. Being sent to the publisher, the text will be edited (most likely using a series of software), sent back to the author, to be edited by them. This adds up to more computers for the publisher and copyeditor, possibly more software or virtual storage, and e-mail exchanges. When the final version is drafted, it will require other digital skills in order to conceive and implement layout, involving personnel as well as software, and probably installed on yet another computer. The proofs will then be circulated, needing electricity and bandwidth, as well as the book's cover. Once the proofs are validated, printing can be initiated. For printing, specific machines are necessary, monitored by computers, and more machines and more computers to produce the printed book. The printed books are then bound, wrapped in plastic foils, packaged, and sent to the publisher, who then dispatches the copies to author, bookstores, libraries, and critics, accompanied by promotional material — a description in their catalogue being the bare minimum. This adds transport, more printing, and personnel skilled in advertising.

For an online version of a book, a conversion into digital formats such as HTML or e-pub will necessitate additional skills and software in the production cycle, as well as a fitting device at the reader's end, with the necessary software, electricity for consultation, bandwidth for download, and virtual storage for the ebook. For the physical book, reader endpoints also encompass storage of some sort, even if only a bookshelf in a bedroom. All of these output endpoints, whether e-reader, or shelves in a room, should in the end be taken into account for each reader and/or person who purchases the book or accesses it in another way.

While the overall assessment would come out differently depending on a variety of factors, such as the number of copyedits, the quality and quantity of print, and the type of distribution and of media coverage,

you can see that in the case of publishing, carbon expenditure includes buildings, skilled personnel, primary resources (wood and water) for the production of paper in large quantities, industrial equipment, IT equipment (hardware, software, and storage), transport of goods, and a wealth of energy to make it all work. In terms of trade-off, it is not simple to evaluate whether completely giving up on printed versions would be the right solution in the long run: while there would be some saved energy in production and distribution, even more people would have to purchase devices such as e-readers that could display the books. This means having to produce more e-readers, and more access to virtual storage that will be solicited by more people. Rebound effects, which force the development of environmentally costly solutions in order to avoid other environmentally costly solutions are challenging to assess. What is more, the use of binary formats in the field of digital publishing makes the sustainability of strictly online solutions uncertain. Will we be able to read an e-pub produced today in 10 years' time? A look at your bookshelves will tell you that you do not even have to ask yourself that question when it comes to a good old book.

What do things look like when it comes to a digital edition, a digital scholarly edition, for instance, that is conceived to be consulted online only, mainly in a web browser? Considering the challenges in measuring its environmental impact, a digital scholarly edition is a sort of hybrid between archiving and publishing a book. Its business model is closer to an archive if it is funded by a public grant. Although it can of course be funded by a commercial enterprise or a foundation, in my hypothetical experiment, I will consider a public research endeavour. The missions of a digital scholarly edition are close to those I identified for a published book, in the sense that its goal is to disseminate text online in a text format, and not, as archives would do, primarily through metadata, enriched in the best cases by an image of the text. There exist digital scholarly editions carried out by publishing houses and some that are edited by archives, but I will consider the case of a digital scholarly edition realised by a team of scholars, in cooperation with archives providing material, but completely independently from commercial publishers. This example is not fictional at all; it builds on my own editorial practice of the past ten years, and uncovers aspects that the other settings that I have mentioned, either archive or publishing house, did not immediately bring to the light.

Procuring a digital scholarly edition usually requires scholars to apply for grants within the scope of dedicated funding opportunities. In my assessment, I will ignore the energy the applying scholar invests in the application itself, but will start counting at the moment that budget has been granted.[10] From there, budget constraints will dictate a series of technical and scholarly decisions that I will also ignore in the following, though knowing perfectly well that what I may present as a variety of choices is usually pre-determined by the amount of money, time and manpower available in the granted budget.

The production of a digital scholarly edition relies on a team of scholars who usually have complementary skills. I simply brushed over the question of skills above when I mentioned archives and publishing houses, but it is worth looking into questions of personnel training in a little more depth. Trying to assess the environmental impact of skilled personnel would require one to evaluate the cost of their training and include it in the calculation. But things are not that simple. On the one hand, someone who has studied extensively comes at a high societal cost since they received an education over a lengthy period; however, because they studied for a long time, one could assume that they will be more efficient at working once they have completed their studies than someone who has not received as much training. Again, evaluating the environmental cost of professional skills requires one to balance elements that are not easy to compare with one another. In the case of a team of scholars procuring a digital edition, there will probably be a principal investigator who is well-trained and experienced, and alongside them, one or more less trained colleagues who are likely to become experts along the way. Training young scholars costs time and energy up to the point when it starts saving a lot of time and energy. The cursor moves between the two phases more or less quickly depending on the personalities of trainer and trainee.

The scholarly team will work in cooperation with an institution providing primary sources (an archive, a library, maybe even a writer), and with an infrastructure providing server space and other technical settings necessary to access the editorial work. This can be a university datacentre or an overarching infrastructure that provides webspace, the setup for a

10 The responsibility of funders (admittedly limited to the question of academic travel) is addressed in Bousema et al., *Critical Role* [29].

database, protocols for exchanging information, etc., at regional, national, or international level. Both the primary source provider and the infrastructure will have at the very least rooms in a building, personnel, and an energy consumption that will be dedicated in part to communicating with and providing services to the editorial team.

Within the research team, communication channels will include e-mail, file storage, videoconferences, actual meetings, work sessions at the office and at home, and maybe at a library or archive (involving different buildings to maintain); team members will each have at least a personal computer and a cellphone, probably an external hard drive as well. For a somewhat more comfortably equipped team, there will be additional monitors, headsets, tablets, keyboards, and a wealth of devices that are likely to come in handy in editorial workflows.[11]

Not all devices of the same type have the same environmental impact. For instance, energetic efficiency can vary from one laptop brand to another, or even between models. It is anything but easy to gather detailed information on the impact of a specific digital device. To assess the overall impact of a device (or, for that matter, of a digital service), it is necessary to consult the related technical report called lifecycle assessment (LCA).[12] A lifecycle assessment examines one device such as a cell phone or a personal computer and assesses its environmental impact, taking into account phases of its production, distribution, use, and end of life.

11 In order to understand the relative importance of the different elements involved in digital media such as devices, energy consumption, infrastructure, etc., the MOOC "Environmental impacts of digital technologies" is a good starting point: `https://www.fun-mooc.fr/en/courses/environmental-impacts-of-digital-technologies/`. It comes with additional bibliographic resources, see `https://learninglab.gitlabpages.inria.fr/mooc-impacts-num/mooc-impacts-num-ressources/Partie3/RessourcesComplementaires.html?lang=fr`. See also Marquet et al., *1024* [81]. To give a concrete example that encompasses not only greenhouse gas emissions, but the impact of IT at large, see a report by French Association for Network Regulation ARCEP (`https://www.arcep.fr/uploads/tx_gspublication/etude-numerique-environnement-ademe-arcep-volet02_janv2022.pdf`), which shows that terminals are in most regards the main item in environmental cost of production (Table 103), while datacentres are responsible for the major part of energy consumption in the use phase (Figure 32).

12 The Wikipedia articles dedicated to LCAs are of variable quality at the point when I write this. The English article is not considered as not consolidated enough (`https://en.wikipedia.org/wiki/Life-cycle_assessment`), but the French one meets all quality criteria (`https://fr.wikipedia.org/wiki/Analyse_du_cycle_de_vie`).

The first part concerns the production phase. This means looking at every component of the device, and what they are made of. For instance, they are likely to be composed of rare metals, and the extraction of rare and irreplaceable metals not only lowers the overall limited stock of the resource itself, but also impacts water resources in some cases, or the surrounding biodiversity. In a lifecycle assessment, you will find up to 40 criteria such as the impact on water resources, biodiversity, global rise in temperatures or in sea levels, evaluated for each of the elements the device is composed of. The values are then added, taking all components together in order to give a general evaluation. Since this type of information is not available for each device for each brand, lifecycle assessments work with typical or average known values for similar devices. In other words, it is not fully possible to know which device is better than another similar one because detailed information on the production phase is seldom available.

The production phase usually takes place in countries with limited respect for human rights and not infrequently involves slave-like or child labour. How can one account for that, environmentally and, more broadly, ethically? Stepping into the shoes of a scholar who would do their best to purchase reasonably ethical devices with their public funds, it would be difficult for them to make a case for one specific type of device. It would require an excellent knowledge of highly technical parameters, even before considering the use they will make of it.[13]

Lifecycle assessments of digital devices also evaluate their impact during the phase of use (energy consumption), and the end of life. The lack of satisfactory recycling schemes and the overall growing gluttony of digital devices plead for solutions with the longest warranty and the highest level of repairability.[14] This remains mainly an abstract theoretical stance in the case of an editorial team from the northern hemisphere, because the pollution induced by digital devices that have ceased to function is not likely to be of an immediate inconvenience to a European or

13 In France, guidelines are now provided at national level. See `https://ecoresponsable.numerique.gouv.fr/publications/guide-pratique-achats-numeriques-responsables/`.

14 Despite efforts towards the regulation of WEEE (Waste from Electrical and Electronic Equipment), this remains an underdeveloped leverage towards sustainability at the time I write this. European Union regulations on WEEE can be found here: `https://environment.ec.europa.eu/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee_en`.

Northern American scholar: digital junk is disposed of in lower-resourced countries. Biodiversity loss and increased sicknesses due to poor disposal schemes of health-threatening components affect their population, not that of the countries who have used the device while it was working.

Let us assume that the scholarly team wanting to procure a digital scholarly edition has found a way to make an informed and reasonable decision on the digital devices they will purchase with their public funds, that the primary resource provider too will have purchased scanners that are ethically responsible, and that the datacentre they work with is as transparent as possible about the energy they use, and has optimised its facilities to lower temperatures in server rooms, for example, or by using the generated heat for another purpose. Now comes the point where scholars specialising in digital editing can legitimately be asked to make informed decisions. These will concern the data format for the source code, the overall architecture of the database, and visualisation decisions regarding the presentation of the output on a web interface.

In order to make decisions, the editorial team needs to address the environmental impact of production, particularly related to the use of their edition: what happens to a user if they want to access the edition? How much energy will it require from them and from the datacentre that will send the information? How good does the internet connection have to be? The environmental cost of maintaining access is very different depending on the technical setup, whether the web content is actually fully available at all times, or whether it is generated upon user request, based on straightforward scripts that are quickly executed. This is what the editorial environment of TEIPublisher provides: the possibility to generate the requested pages on demand, without having to maintain the whole edition online all the time. It has the additional advantage of relying on economical — sober — and sustainable technologies such as XML-based files, and can be installed on servers of large infrastructures.[15]

After a process of information and reflection that is rather long and complex, the editorial team could have found a way to realise their digital scholarly edition. Once the edition is available, they then have to make

15 See `https://teipublisher.com/index.html`. In my own work, I use the TEIPublisher instance deployed on the French research infrastructure Huma-Num (`https://www.huma-num.fr/`). The *Digital Scholarly Editions* platform can be consulted at `https://discholed.huma-num.fr/exist/apps/discholed/index.html`.

their work known and have people actually use it. In other words, they have to write articles about it; to present it at conferences to connect it to other scholarly editions. These are additional, environmentally costly work steps — even the choice of the Open Access option will have some impact.[16] And beyond publication strategies, there remains the question of academic travel. Should scholars attend conferences, travelling, sometimes by plane across oceans, to present their work? It adds another source of pollution to the whole process, and questions yet another traditional academic habit.[17]

In digital scholarly editing, each step of the process deserves to be examined under the lens of its environmental impact, to lead, if not to systematic reassessment of priorities, at least to raise awareness of the global impact of the process undertaken in order to give what editors think is the best access to the best text for the most people.

From the point of view of those who make text available, the contradictions that these processes involve can hardly be addressed in a satisfactory manner. On the one hand, for all the actors I have mentioned, be they archivists, publishers, or scholars, the standard *modus vivendi* in north-western countries is that of a fierce competitiveness, leading to an inflation of activity, of production, and of the general visibility necessary for professional survival. On the other hand, a game with as yet unwritten rules that takes account of the global environment tends to go in the opposite direction and requires us to look into things we do not know about precisely; to take time, to minimise efforts, to avoid all things shiny. It affects nothing less than species and planetary survival. The tension between these two opposite aspirations is an unbalanced one. Decades of professional habits have left their mark on the first one, while the other seems to contradict even the idea that there is room for individual leverage on infrastructural questions in a professional context.

16 I definitely take for granted that green Open Access, with no barriers and little editorial added value, is more environmentally friendly than gold Open Access, which can only be accessed through a paywall with data tracking, relying on tailored hosting solutions and in-house formats. Depending on their technical setup, diamond Open Access options might be closer to green or to gold in terms of their environmental impact.

17 The recommendations published by the *Berlin-Brandenburgische Akademie der Wissenschaften* and the *Junge Akademie* in July 2022 provide an excellent overview of state-of-the art research on academic travel, together with action points suggestions. See Gerhards et al., *Klimaschutz* [59].

For a random individual in this socio-economic ecosystem, there is no obvious reason to take the long road to sustainability, as it is not paved with incentives, recognition, or better work conditions. Temporalities play against one another.

From the point of view of those who want to access text, much of what will be within their (digital) reach depends on where they live on the globe. Despite what some may want to believe, and despite the efforts deployed over the past decades to popularise access to text (including digital access), it remains a luxury and a cultural marker. Especially the technologisation it relies on is likely to increase a legitimate sense of global injustice. For many, the natural losses such activity causes are more visible than digital benefits such as access to cultural heritage.

This imbalance should invite especially actors, particularly those from well-resourced countries, to revisit the notion of what is "technically possible" in the light of climate justice. I, for one, am convinced that taking what might seem a step back is, in fact, a major leap forward. In the following section, I want to draft a few perspectives on this.

3.1.2 Archiving text for tomorrow

A world in which digitisation will benefit all and improve access to care, education, culture, and all the life improvements the industrial era promised, cannot be envisioned today any more. The gap between cost and benefit, especially of digital services, appears all the more cruelly in events where the victims of floods, rising sea-levels, fires, storms, tempests, and poor harvests, are displayed on cell phones, screens displaying information, and other digital media.[18] Digital media keep us informed but they have also become, in their energetic overshoot, part of what causes the problem, as is shown by studies on the growing energy needs, especially in the domain of the cell phone and internet connection.[19]

18 On the connection between socio-economic mechanisms, especially connected to information dissemination, and digitisation, and on solutions to improve current problems, see Lange and Santarius, *Smarte grüne Welt* [74]. The French Agency for Ecological Transition ADEME has developed four scenarios to achieve carbon neutrality in France by 2050. Only one ("pari réparateur") relies heavily on digital technologies as we know them.

19 The development of 5G is a keystone in the report by the Shift Project on the environmental impact of IT and their recommendations for a more sustainable digital future at EU level: `https://theshiftproject.org/article/impact-environnemental-du-numerique-5g-nouvelle-etude-du-shift/`.

In this challenging context, access to text is an individual issue as well as a societal one and, for some, it is also embedded in professional choices. As a reader, you can choose to buy an analogue book or to purchase an e-reader. A first step to understanding the implications would be for any reader to be able to gain a general sense of the environmental impact of these choices.

But these impacts are all the more difficult to explain unambiguously as they are embedded in national and global structures that add up to more than the sum of individual choices. Economical mechanisms, social relationships, existing (or non-existing) infrastructure, and the weight of political decisions past and present — all of these are at play, intertwined with one another.[20] From the moment when you are part of a society, you have an environmental impact. Social determinism is not the most consoling and satisfying thought here. Would it not be better to cease all activity, meaning, in the case that I am talking about here, to stop reading books altogether to substantially minimise our environmental impact? It is an argument that can be applied similarly to other activities, such as the use of a car, or of a computer — it extends to any human-made artefact.

I would like to draw a parallel with a historical situation in which it was not the environmental cost, but the financial cost that kept readers from buying books.[21] In the late 18th century, literacy goals had born fruit and a much wider array of the population was now able to read. In urban contexts, the cultural capital represented by the knowledge of texts one had read was socially of great interest and potentially a door to better socio-economic conditions. This educative and social validation of literacy led more and more people to gain interest in books and the press. These were not people who wanted to possess books in order to show off, as could be the case in aristocratic milieus, but people who wanted to read translations of the latest novels, practical advice, ideas about hygiene, or poetry. To them, however, printed press and printed books were extremely expensive compared to their income. Several systems were set up to share the cost. In some cases, several people took one subscription to a journal and shared it for reading; then each one of

20 See Charbonnier, *Abondance* [36].

21 The following draws from chapter II.5, "Der literarische Markt: Genese, Strukturen, Funktion /Das Publikum" in Kiesel and Münch, *Gesellschaft und Literatur* [72].

them in turn got to keep a copy. Depending on how many people were contributing, it could be every other issue or every third, fourth, fifth, etc., issue. In other cases, they paid a weekly or monthly fee that authorised them to consult and read, in a dedicated room, freshly published items. Some of these library systems were efficient business models for the organising entrepreneur;[22] some were more self-organised by people who put their minimal savings together in order to follow the feuilleton-based adventures of their favourite heroes. But all in all, the trick was to split and share.

While taxing products and services according to their environmental impact could be an interesting experiment to address the issue of reducing the proliferation of greenhouse-gas-emitting artefacts and services — if applied systematically and fairly — such a measure remains to this day out of reach politically and socially on a large scale in the most polluting countries. There is no alternative but to come up with other ways to encourage practices that limit greenhouse gas emissions, perhaps taking inspiration from 18th-century reading circles when it comes to cultural artefacts like text-based media. Without going so far as to nationalise all services, the rule of thumb to minimise impact could simply be that the greater the number of people benefiting from an artefact, the less impactful it is for its single use. Borrowing a book from a friend or a library, or sharing a downloaded digital resource locally are all gestures of reuse that minimise the individual environmental cost for using the concerned item. The production, use, and end-of-life impact can be split among all those who benefit from it, and the part each individual has to account for is reduced.

Sharing is key, and there are ways to make sharing better than it is.[23] I will not explore the economic leverage mechanisms readers can deploy at an individual level to pressure the book market into improving sharing mechanisms, as interesting as this approach may be. Thinking about leverage on environmentally friendly access to text, one central entry point for the development of good practices — and one that perhaps deserves more consideration — is on the part of those who produce text, rather than those who consume it. Let us turn now to those actors for

22 A good example is presented in Busch, *Lesezimmer* [32].

23 This aspect is also key in the recommendations made by Lange and Santarius in *Smarte grüne Welt* [74].

whom access to text is not simply a cultural leisure activity, but the core of their professional practice. What take do archivists, publishers, and editors have on the environmental impact of their professional activity?[24]

Wanting to reduce one's environmental impact means striving for a greater energy sobriety. There are several ways to improve things that can be combined differently, depending on the goal. If the goal is to reduce impactful emissions to zero (which would be the basis of what is called carbon neutrality), activity has to cease altogether. Offsetting by planting trees will never fully account for the impact of a digital service: the trade-off of offsetting might make a plausible argument in some areas, based on greenhouse-gas-emissions calculations, but it cannot compensate for larger losses like those in biodiversity or in water resources. From that point of view, the only way to be sure to emit as little as possible is to do nothing. As tempting as this radical option may seem, I will look into less efficient, but less disruptive alternatives.

I will presume that mankind does not purposefully want to self-annihilate in the near future, but strives to pursue something like meaningful human existence at a global level, seeking a form of collective life where not everything is about survival, but where culture at large is part of social cement. For archivists, librarians, publishers, and editors to conceive their activity in such a way that it does as little natural harm as possible, for the largest possible cultural good, it means paying close attention to at least three elements: natural resources, human activity, and energy consumption.

In order to improve the assessment of natural resources consumption in this context, we would need a much greater transparency in information. It is striking how a lack of precise information is the common denominator in the literature dedicated to assessment analyses. This means that in a first step, energy (meaning money, personnel, and actual energy) should be invested in making information on machine components and information transmission infrastructure easily available. In the case of public actors such as archives, libraries, or research institutions, public markets for purchases should take these elements into consideration, offer long warranties, encourage reparability, and provide spare

24 In Germany, the *Netzwerk Grüne Bibliothek* has been active for a few years already and provides expertise on sustainable models. They also supply a related bibliography: `https://www.netzwerk-gruene-bibliothek.de/bibliografie/`.

parts and repair. Training public servants to repair the devices they are using in everyday life, or at least to identify what is to be repaired and providing workshops to do so, would, on the one hand, reduce material consumption and spare natural resources and, on the other hand, modify the way we think about our material environment. This could be one of the most important shifts I can think of: not to consider that we are entitled to surround ourselves with tools and services, but to acknowledge the support they provide. This means moving from being annoyed by the cable that does not work anymore to taking good care of one's cables in the first place, looking into repairing and recycling options, and, if it is absolutely necessary to purchase a new cable, then buying one that was produced in conditions that are environmentally acceptable, or checking the availability of a second-hand cable instead. All in all, this means dedicating much more time to the materiality of our environment than we are used to in north-western countries.

More broadly, the notion we have of the time we dedicate to a productive activity with an environmentally impactful output needs a reassessment. As the example above suggests, care for the materiality that surrounds us is bound to take quite some time, especially in the immediate future, considering we have no simple way of gathering the information needed on the impact of our devices, and no simple way to compare options in terms of their environmental and ethical impact. Pioneer work is still required. Reducing the time dedicated to an impactful productive output has an added advantage of making more time available for activities like gardening, barter, craft, and other socio-cultural activities that can be recentred at a more local level, and contribute to lowering overall impact. They would lower overall energy consumption too.

How, in such a setting where the tendency would be to reduce activity, would we manage to guarantee long-term access to textual material? In this field too, energy-saving measures have to be taken. The best measure would be to start before it becomes too complicated — before it is too late and archivists and librarians actually have to choose between cooling the stock room, cooling the server room, or cooling the consultation room when energy shortages and heat waves have become our daily reality and it is not possible to cool all three rooms to counter the 45-degrees Celsius outside temperature. In some respects, optimising existing technologies

can make a big difference. In others, we will have to make choices. It will not be possible to archive everything (not that it was possible before, but digitisation might have given the illusion that it did), and it will not be possible to archive in as inflationary a manner as we have done over the past decades. Choices will have to be made, and the criteria for these choices will have to be defined. As I have shown in section 1.1.1, choices in preservation strategies are a highly political issue. However, some of the parameters that come into consideration are not political, but technical.

The many representations of digital text that exist, such as image, raw text, annotated text, metadata, etc., come in different formats. Each different format has a different environmental impact. Simple text like that in metadata or in raw text files is materially close to insignificant compared to a high-resolution scan. Visualisations based on complex calculations are also much more energy-intensive than raw text. Reduced to its duration of life in correct preservation conditions, paper is not necessarily the worst option. At this point, the most efficient way to keep a trace of a textual document may be to provide rich metadata (an index in a digital format that is compatible with other formats) and raw text. The metadata can include information on the materiality of the text and contribute to not losing completely the formal dimension for the sake of preserving semantics. But to be perfectly honest, while we have reliable experience when it comes to preserving paper for several hundred years, our projections are much more speculative when it comes to digital-based formats. A minimal set of purely textual digital information for born-digital documents, in combination with a paper support as far as it exists, could make the core of a sober approach to archiving and making available textual heritage in at least some quantity and some quality. What desirable quantity and quality are remains to be defined more precisely. But I would argue that a sensible approach based on these principles would make it possible to pursue both popular heritage transmission and scholarly work.

Anything that goes beyond this core information should be done in a computer language that is compatible with other languages and that would make it possible to version the file in the manner that was described in section 1.1.2: archiving the basic text in an economical manner, and simply recording changes made over time after that. By proceeding

in this way, the virtual space required for archiving remains limited, especially compared to current practices where archives often procure a high-quality scan in TIFF, a high-quality scan in JPG, a lesser quality scan, and a thumbnail of the same manuscript page. Sometimes they even reload all images on each archiving iteration, including those that have not changed in between. There is certainly room for improvement in the current processes.

Procuring the files is one thing, preserving them requires infrastructures. The more institutions and actors share infrastructures, the less environmentally costly they are. Much of the impact of preservation strategies will come down to the way in which datacentres are built, and to their file exchange protocols. For their virtual stock to be shareable, large infrastructures could rely on networks of information that can harvest information as well as distribute it. These networks may be virtual for the users, but they are based on actual cable infrastructure that needs, again, to be conceived in such a way as to optimise the circulation of data. This concerns not only the cables and their dispatch form, but also the type of data they have to transmit. Improving environmental impact can mean favouring some formats over others, such as those that need less bandwidth. On the receiver end, too, energy saving can mean that only the lightest data is transmitted. What happens when you have low bandwidth and webpages load very slowly? This experience gives a sense of all the energy-intensive and superfluous information that is being transmitted with each and every internet request: banners, colours, animations, and videos that start automatically as soon as the page opens.

What is true for infrastructures and for internet protocol is also true for what I would call editorial information. If we want to be able to preserve more than the raw text and a description of page, paper, ink, and writer, this needs to happen in a standardised manner, so that as little energy as possible is used to convert the encoded information and make it legible in various computer systems. We could, for what I have called inherent history and geography of the text in section 1.2.1 for instance, define a set of the information that is likely to be relevant for almost any text, or at least literary text, and agree on a stable way to represent this information digitally. It is fortunate that this is what the TEI consortium has been doing for the past decades already, procuring a solid basis for even complex textual phenomena. Going one step further, the imple-

mentation of this standardised, stable, economic way to provide textual and meta-textual information can also be standardised in terms of the workflows it is integrated into. Here, too, editors worldwide could work out a way to arrange the essential digital building blocks that make it possible to progressively enrich text and preserve it in a progressively enriched and enrichable form, thus guaranteeing the availability of basic information and making additions possible. This would mean that archives, libraries, publishers, and scholars all somehow work with a similar, standardised, economical workflow.[25] Of course, this bears the risk of losing information because of its standardisation. But considering today's competitive situation where binary formats jockey for attention, I do not think it would be worse than the loss we would be faced with when we need to save electricity, and datacentres have to be turned off.

Even in a situation where we would have reduced usage to a minimum and saved as much energy as possible in procuring the data basis for textual heritage, the question of duplication remains a crux. Duplication means that datasets are being archived in at least two different locations that mirror one another. If one of the locations ceases to work, or burns down, or if its hard drive content gets erased or crashes, the other iteration can provide backup. Relying on one single copy of digital files is a risky business. But the environmental cost of multiplying by two — if not even by three for a backup of the backup, as is often done — comes down to asking the canon question anew. What exactly justifies a text being preserved in not two, but three high quality copies, in order to be sure, absolutely sure, that it will not be erased from memory? How much are these scans of manuscripts worth for mankind that archivists, librarians, and scholars try to guarantee they will never be subjected to the fundamental rule of any archive, which is that loss and destruction are unavoidable, are part of the process, and have to be accepted as the epistemological premise of all archiving?

In this case, it seems that it is the quantitative dimension (the weighty scans, duplicated two or threefold) that serves as an affirmation of cultural superiority. Yet impact could be more strongly determined at a quality level. Taking technical decisions on formats is also a way of aiding

25 In *TEI Models* [16], Julie Giovacchini and I propose a TEI-based approach to reviewing and copyediting processes. Ultimately, the goal would be to strive for an even wider generalisation.

selection processes. In this type of selection processes too, politics play a part that is not so different from that of 19th-century Germany erecting a cult house to Goethe and Schiller. Topics are prioritised by ministries, funding is made available for these topics, and the amount of funding determines technical choices, and with them the sustainability of the textual resources that will be procured. In this case, much is in the hands of establishment. At best, a small group of educated experts can formulate recommendations. But it has hardly gained transparency in the selection criteria, and is still dominated, at a global level, by English-speaking, educated white male production.

I see a convergence between this form of (political) control on textual content and control on the means of dissemination. While shared infrastructures offer the best guarantee for sustainable preservation, they should ideally rely more on distributed community-based needs and solutions, and not unilateral benefit resulting from top-down instructions. Infrastructures providing long-term hosting of textual heritage should be able to serve as the backbone for initiatives that have little to no means: for instance, a low-cost Raspberry Pi computer and some manpower, with very parsimonious resources, such as those powered by solar panels that are only accessible when the sun is shining.[26] In fact, making digital resources available in different forms depending on an energy scale defined by current physical conditions could be an interesting direction to think about. Instead of making everything accessible all the time, core information could be accessible at all times, and additional information only when renewable energy is available. This would generate new hierarchies between what is deemed indispensable and what is secondary, but at least there would be a coherence, a logic behind availability schemes.

Who, though, would understand that logic? How can it be made comprehensible to users and readers? This question is not only key when it comes to retrieving digitally archived textual material in the long run, but more generally for all the challenges a shift in text access practices is bringing. Current practices have spoiled users to the point that any reader can have the illusion that a plain text search in a browser will open the door to whatever it is they are looking for. This is far from true, as I explained in section 2.2.1, but this misconception is not likely to

26 See `https://solar.lowtechmagazine.com/`.

disappear soon. Instead of fostering the delusion that it suffices to know a title and/or an author to find a text, it would make sense to develop educational schemes that provide training in the skills necessary to gain orientation for a digital environment in a context of shortness of resources and ecological mindfulness.

The education I think of would entail a basic training in environmental awareness (covering, among others, the topics I presented in section 3.1.1). It would also train in code and programming literacy, empowering students to be able not only to read and unpack, but also to assess the relevance of computer language choices in the different settings they might encounter. Guidance in heritage selection mechanisms would also be part of it. I wish that my students and children will know better than me how to read XML, how to use a Raspberry Pi, how to work with minimal computing features, and how to manage a simple database. At the time of writing, this type of training is reserved to a handful of ICT students. To me, this type of training is what philology for tomorrow should entail. These are the skills philologists need to develop if we want to have a chance to build our school and higher education curricula on more than a handful of random Google Books.[27]

I strongly believe in educational schemes carried out by professional institutions like state schools or publicly funded universities. But this is perhaps too restrictive, and so is thinking that it is up to the next generation to carry out the change. Maybe this kind of training should be developed on a more widely distributed and accessible level, such as community colleges or *universités populaires*, for people of all ages as long as they understand what is at stake. Maybe it is the wisdom of the masses that will help us renew the canon and keep textual heritage alive, even if only on the days that solar panels can provide energy.

3.2 Trying to make this book an environmental lightweight

The comprehensive character of environmental issues, and the extent to which they are embedded in social processes at large, means that

27 I am aware that this is more a concept than an actual training scheme. It leaves unquestioned, as the rest of my argumentation does, the fact that spending a lot of time with one's eyes locked on screens is problematic. What digitality does to bodies is certainly another aspect that needs to be taken into account in this discussion.

addressing them requires, as I suggested above, also a comprehensive response. Material production, individual activity, infrastructure, and workflows need at least to be adapted, if not revised in depth. In the face of all the necessary changes, it remains difficult for environmentally aware individuals to reconsider their own activity in such a way that they do not feel as though they are encouraging inadequate advances, or even develop a sense of guilt about having any activity. The anxiety generated by the sole effort of scrutinising and measuring each of one's step in the world can easily become paralysing.[28]

While it is not the purpose of this book to encourage readers to measure every single one of their activities in the light of its environmental impact, I would like to try to give one concrete example in this last section. My goal is to list the elements that should be taken into account in order to assess the environmental footprint of the conception, production, distribution, archiving, and use of the book you are currently reading. This approach was greatly facilitated by the publishing house, Open Book Publishers, who contributed essential information to the following pages.[29] By diving more into this self-reflexive case study, I intend not only to give a sense of the type of analysis that is necessary to tackle the challenge of initiating practical shifts in key areas. I also want to outline what a coordinated approach, involving the wealth of actors that have leveraging potential to shape access to text for tomorrow, could look like, on the basis of contributions from our current period, which is one of transition.

I begin by presenting the production phase of the book, starting with my own work processes and including those of the publisher. I then move to distribution and archiving strategies, and strive to consider reader behaviour as well.

3.2.1 Writing, printing

At the risk of disappointing readers, I must confess that I hardly used any paper and pen to write this book. This does not necessarily mean

28 See Panu Pihkala's synthesis on *Eco-anxiety* [88].

29 I would like to thank Open Book Publishers for their support in this endeavour that required an unusual transparency about internal work processes. In particular, I am grateful to Rupert Gatti for communicating internal documents and information, and engaging in an extensive discussion with me on different aspects of the argument developed in this last section.

that the definition of the onset of the writing process is any easier to identify. In fact, chapters 1 and 2 are largely inspired by earlier publications I wrote and disseminated in a variety of ways over the past ten to twenty years. Most of them have in common that they are preserved and accessible on the online archive HAL,[30] except for the digital scholarly edition *Letters and texts. Intellectual Berlin around 1800*, which was first hosted by the German Trier Center for Digital Humanities,[31] and whose long-term archiving is now ensured by French Research Infrastructure Huma-Num.[32] The preservation and long-term dissemination of these earlier drafts rely on shared public infrastructures.

Both my own earlier publications and the bibliographical information I refer to, chiefly in my footnotes, build a network of explicit intertextuality. In the course of the writing process, I had to check page numbers for quotations or relevant passages, I had to ascertain the wording of citations, and to confirm publication dates. This type of bibliographical quality insurance is a requirement for scholarly work. It involves time and effort in addition to the writing process itself. I did not have to go the library very often since most of the references I had been using were also part of earlier publications I had already been consulting. Library visits for the purpose of writing this book only relate to my Oxford stay in the spring of 2022. From my home in France, I took the train to Oxford and, from my Oxford home, I walked to the different libraries I visited (Taylorian and Library of the Maison Française). It remained rather low-key in terms of impact compared, for instance, to my early career stays in a variety of archives and libraries around the world.

Apart from these visits to actual libraries, I also had to consult references in online libraries and archives for additional details. I usually used meta-catalogues that I already knew well, so that I did not lose too much time browsing the web. When a resource was behind a paywall and inaccessible via my university portal or other libraries I am a member of, I had to resort to other freely accessible resources used by scholars. Assessing the impact of this online activity requires me diving into the footprint of libraries (virtual and physical) and download platforms, their preservation and distribution policies, and each reader's strategy

30 See `https://hal.archives-ouvertes.fr/`.
31 See `https://tcdh.uni-trier.de/en`.
32 See `https://www.huma-num.fr/`.

once they are in possession of a copy. We will see later in section 3.2.2 what that actually entails, taking only this book into account.

Evaluating the preparation of chapter 3 added another dimension. I have not been trained in environmental questions in the same manner as in philological ones. I studied philology, wrote a related PhD and a habilitation, and I have been preparing editions for twenty years. My digital training was integrated into my research activity over the past ten years. It took the form of actual trainings in classes, workshops, and hands-on sessions, albeit not as systematic as studying from the onset. Yet, for both the philological and the digital dimensions of this book, I can refer to a classical publication and citation setting, and to an established disciplinary frame of reference, as the bibliography shows. When it comes to environmental questions, my training has been much less systematic — this chapter bears obvious marks of this difference in training quality, especially in the references that frame it. This has to do with the fact that there exists no explicit discipline dedicated to the environmental footprint of dissemination and preservation activities that could be actionable within the research area of Humanities disciplines. The French network Labos 1point5 strives to establish such a field for research activities in general, trying to extend beyond disciplinary boundaries.[33] A large part of what I consider my training in this area consists of interacting with scholars from various disciplines (geography, environment studies, physics, astrophysics, computer science) over the past two years. Yet, to this day, the literature that is discussed and produced in the context of this research network does not address publication issues or access to text at large.

Another French research network, Ecoinfo, is specifically dedicated to tackling the impact of digital technologies, encompassing research activities but not limited to them.[34] Ecoinfo understands itself as a provider of expertise: members benefit from each other's knowledge and experience, and can be trained through interaction and lectures provided within the network. I was lucky to be offered tailored training units by specialists. What I learned about lifecycle assessments — not simply the technical details, but the philosophy of their conception and use — comes out of these e-mail exchanges, training sessions, and discussions in videoconferences.

33 See `https://labos1point5.org/`.
34 See `https://ecoinfo.cnrs.fr/`.

Calculating the environmental footprint of videoconferencing and comparing the different providers is a complex endeavour.[35] There remain so many uncertainties in how to measure and/or model the components involved in this process (from the devices used, to the internet connection, location of servers, image quality, etc.) that it is only possible to provide scales of magnitude rather than precise figures when it comes to calculating the environmental footprint of videoconferencing. This, again, makes comparisons between different software and systems difficult. As long as it is not yet good practice to provide a numerical assessment of any digital service within the service itself, this kind of endeavours will have limited accuracy. On the one hand, this is annoying because it prevents one from providing a clear assessment. On the other hand, the order of magnitude should actually suffice to raise awareness of the overall necessity to reduce digital activity on a massive scale.

Turning back to my initial question concerning the evaluation of the environmental footprint of zoom training sessions relative to in-person workshops, for instance, the comparison requires one to balance uneven elements. In-person workshops involve transportation, buildings, and material, not at all an insignificant footprint. But they also mean improved communication and greater social well-being compared to videoconferences. For videoconferences just as for in-person training, however, one way to balance human activity and preservation of the environmental footprint could be to build distributed networks of competence that make it possible to disseminate knowledge locally through a pool of trained facilitators. This is precisely what networks of competence are doing: while the environmental impact of the training sessions is *per se* rather high, it has the potential to achieve much improvement at a more local level, through trained people. The more people benefit from it at the end of the training chain, the less the overall environmental impact of the initial training session.

The training I received in zoom sessions is also difficult to evaluate in terms of the bundled competence I have benefited from. Networks of higher education and research professionals are composed of highly trained experts. In the case of the two French networks I mentioned, they

35 See the Labos 1point5 and Ecoinfo paper comparing the impact of in-person attendance and videoconference participation at conferences: `https://labos1point5.org/les-infographies/poster-ecoinfo-method`.

bring together the only specialists that exist in small fields that are not established disciplines in and of themselves. The footprint I am trying to optimise here leads me to questions regarding the flexibility of the academic system: what is its ability to make way for emerging disciplinary relevance and integrate it into scholarly discourses, in a context where reference to existing knowledge does not only take the form of books or articles but potentially also podcasts, videos, and executables. These dynamic digital resources present even more citation and copyright issues to deal with than is the case with text, involving the challenges that I mentioned in section 2.2.1. The environmental impact of the production of this book takes into account a fragment of each of these training settings, and of each of these online resources, in the sense that they were seminal to the content I present here, in the book form in which I have brought them together.

Looking now not at the background for the content, but at the technical equipment I have used, the situation is somewhat more straightforward. I wrote this book on a MacBook Air that was purchased by my university in 2018, which I had been using for four years by the time of writing on my computer. I started writing in April 2022 and finished in early September 2022. This initial writing phase was followed by copyediting phases in February-March 2023 and May 2023. On the days I dedicated to it (seldom more than two full days in a week), I spent about eight hours a day writing. I was online most of the time I wrote, and listening to music about half of the time. Using LaTeX, I compiled the document (a single LaTeX file) several times in each hour I spent working on the manuscript. On the days I was working on it, I saved a copy of each daily iteration on an external hard drive, as well as on my University cloud, making one transfer per day on each of the writing days. I have printed the manuscript five times, each time to integrate major edits by third parties or myself, and discussed it over the phone or on zoom meetings for a limited time (two to three hours). If I add up all of this to calculate the overall footprint of the book manuscript, I have to factor the lifecycle assessment of my laptop according to the settings I have in place (screen brightness, screensaver, etc.), of my headset for listening to music, of my hard drive and the University cloud, of internet connections, printing devices from the copy shop, including ink and paper, the consequences of the choice of such a text editor as LaTeX or such a music provider as

Deezer, and the overall electricity consumption during all these activities. This can be done, but needs to combine information that can be measured rather precisely, such as electricity consumption, with elements for which finding the exact information for the exact device I have been using it is unlikely — for instance for my headset, which is a basic model I bought at a railway station a couple of years ago.

I did not make efforts to systematically avoid being online while I was writing, for instance. My goal was not to limit my writing endeavour in order to make it dramatically less impactful; it was rather to see how I could keep the free writing process of my earlier periods of academic activity while trying to limit environmental impact. I did avoid keeping multiple tabs open and limited my dictionary use to three browser tabs (German-English, French-English, Merriam Webster), and I listened to a downloaded playlist whenever I could. These small gestures are really minimal in the big picture, and I consider them minor constraints, just as every historical period has their constraints framing the use of novel technologies.

The more complex the media, the more impact, and the more complex and impactful the archiving process. I applied this principle to the choice of media I used in the book. While I could have integrated graphs, illustrations, images, and colour, these would all have required resorting to more technologies and material at publication, dissemination, and archiving level. This is the reason why this book does not contain anything other than linear text. I purposefully chose not to integrate colours, pictures, or graphs. This required more effort than downloading music playlists. In sections 1.1.2 and 2.2, it would have been much easier to explain the complexity of the different layers of representation involved in digital approaches to text with the help of a few illustrations. I considered the effort of giving up on illustrations worth while not only in terms of environmental impact, but also in terms of inclusivity. Text can always be transposed in audio for the visually impaired, while an image cannot.

The final manuscript for publication presents itself in the form of a PDF generated from the source LaTeX file. During the last month of the writing phase, I interacted with the publisher to discuss copyright and funding, but also layout aspects (so that the final PDF would follow requirements), as well as the content of this section of the book. I also consulted online resources the publisher pointed to. In September 2022, the manuscript

went to the publisher who initiated the peer-review process. The book proposal was sent out to three readers who agreed to undertake the review. Some e-mail communication with PDF attachments was involved there. The peer reviewers then sent their reviews back. The commission editor at Open Book Publishers synthetised the reviews and sent them to me, via e-mail again.The revised manuscript was then sent back to reviewers alongside with a list of the revisions, adding another iteration to the process. Overall, this work step required reviewers to be equipped with a basic digital infrastructure: an end device, whether laptop or tablet, with a PDF-reading software and an e-mail programme.

Once the peer review process was finished, the manuscript was sent back to me. I integrated reviewer comments, adapted my LaTeX file in order to comply with the layout requirements that facilitate the identification of the publishing house, and sent back my final PDF to the publisher. Once the edited manuscript was accepted, I sent it to professional copy-editing, integrated the copyeditor's edits, and then sent the final version of the manuscript to the publisher.[36] It was the publisher's turn to take a final look at the book as an editorial product. In the case of a PDF generated from a LaTeX file, there is no simple change tracking mode for the publisher to edit the manuscript. We exchanged PDF files.

The final PDF was generated by adding imprints and creating two covers, one for paperback and one for hardback editions. The cover files are created at the publisher's end when the number of pages is final, with the help of a design software. The cover is then integrated into the LaTeX file together with imprint information procured by the publisher. It serves as a basis for generating the e-pub version, which can then work as a pivot for the transformation into alternative formats such as those required by commercial distributors.[37]

The printed book is produced by Ingram, an American company that provides books on demand, based on a service called Lightning Source. Obviously, shipping the volumes from another continent is not really optimal for me as a European author, but considering distribution is not to be limited to my own country, the notion of the centrality of the printing process is a relative one. Emerging models of cradle-to-cradle presses

36 I am immensely grateful to Elizabeth Rankin for her magnificent improvements of my text during the copyedit phase.

37 Section 3.2.2 elaborates on this aspect.

focus on using certified material whose impact is maximally lowered, but this model is not implemented widely enough to be recognised as a solid one for scientific publishers with specific market requirements.[38]

In the phase of conception, preparation, and production of the output PDF file, there is not much room for alternative processes; there is at any rate no easy and obvious way to optimise them. Using an open-source software like LaTeX rather than a commercial text editor already modifies substantially the workflows compared to what publishers are used to. There exists no standardised way of writing, reviewing, editing, and preparing for a generic representation even of scientific texts today. Several types of software, formats, and processes come into play, which may be more or less open, and more or less compatible. Moving to a radically more environmentally friendly process would require to introduce profound changes of habits in a field where it is already difficult for small publishers to find an economically viable balance. In terms of the pressure imposed by the market on the publisher, I have remained, as an author, free to make a range of decisions and, since I am curating the source file, I retain complete control over the text document.

Much of the impact related to the production of this book has to do not so much with the production itself, but with the next step: its dissemination to an audience. In the next section, I look into distribution circuits for the published book and its archiving for later consultation.

3.2.2 Distributing, archiving — and the readers

Being able to actually hold the printed book in my hands is certainly satisfactory. Knowing it has been made possible without contributing too massively to processes that undermine the preservation of natural resources even more so. Only a few copies have to be printed for traditional library distribution, to be sent to the UK branch of Gobi (Global Online Bibliographic Information), and a few more for selected journals that are likely to commission reviews. All other prints will be on demand, when ordered by either libraries, bookstores or readers.

But if the goal was to reach an audience as wide as possible with as limited an impact as possible — and it is — the book artefact is only a

38 In *Zwischen Resilienz*, Wittenbrink presents an experiment with cradle-to-cradle presses and explains its mechanisms; see [103].

nice by-product. Free online access can reach many more people. Yet the extent of its success at reaching a wide array of people depends on the form of publishing and the type of dissemination involved.

I could have chosen to self-publish this book. As I have explained in section 2.2.2, self-publishing has become a fairly straightforward endeavour in the digital context. To publish this book, I could have set up a webpage, written a series of blogposts, or simply have deposited it in a pre-print archive. I could have made the text available for peer review using an open peer review platform if I wanted to integrate some form of quality control.[39] Citability could have been guaranteed through the stable URLs provided by the infrastructures hosting open pre-print repositories or scholarly blogs, depending on the form I had chosen, which also guarantee long-term archiving in the output format.[40] Since the only feature is structured text, layout would not have been much of a problem.

But I would have had to maintain the webpage or blog, or rely on the platform I used to do it, in order to guarantee access to my text. When relying on an online framework provider for publication, one does not really have a say in the preservation and access strategies pursued by the provider. While the publication process would be taken care of via an existing technological solution, and while generic harvesting would improve findability of the text compared to, for instance, a basic print version, it would be fully up to me, the author, to arrange for the text to make its way to its audience. Such input as professional proofreading and editing, layout instructions, and audience access would be limited. Nor would it provide a clear notion of the environmental impact of the deployed technological solution. Working with a publisher facilitates all of this, and working with Open Book Publishers has the advantage of bringing an exceptional transparency and a reliable technical quality assessment to the process. Also, since I am not transferring the rights on my work, which is published under a CC-BY license (requiring the author to be named in case of citation or reuse, but without additional restrictions to reuse), there is nothing to prevent me from engaging into

39 For instance `https://web.hypothes.is/`.

40 The scholarly blogging platform `https://hypotheses.org/` provides stable URLs and ISSN numbers in coordination with the French Bibliothèque Nationale; the preprint archive HAL `https://doc.archives-ouvertes.fr/en/homepage/` also provides stable URLs for each version of a scholarly work they store.

self-managed dissemination in addition to the professional distribution provided by the publisher.

Distribution of the digital book by Open Book Publishers takes place primarily via their website,[41] where the PDF and the e-pub of the book are hosted under a dedicated URL and referenced through a unique DOI. They are accessible without charge. The webpage of Open Book Publishers is kept minimal in terms of design, so that download time, and hence the energy required for download, is curtailed.[42] From there, distribution is extended to what could be considered mega-catalogues, which consist of metadata aggregators that are either library-based or connected to larger infrastructure projects. These providers use the metadata, but they rely fully on the Open Book Publishers website and link to it. These massive databases aggregate metadata of Open Access resources, making them more easily findable than they would be if they were listed only on the publisher's website.[43] This remains fairly economical as long as it is not excessively multiplied (internal documentation points to about ten such metadata aggregators for Open Book Publishers) and as long as metadata can be exchanged in a standardised manner. In any case, metadata transit remains a not too costly process environmentally compared to content exchange.

The situation is more worrisome when it comes to the dissemination via digital book distributors, who gather and distribute not only metadata, but also content. These commercial actors usually develop their own formats, and the e-pub output has to be transformed again in order to be accessible via Amazon or Google Books. Additionally, they generate their own URL, sometimes even their own DOI, for the same book that is already referenced on the publisher's website. This redundancy is neither good for the environment nor for the advancement of knowledge. References are much more likely to get lost if they are equivocal. As if multiplying home-made formats and DOIs for the same text entity was not bad enough, some of these book distributors apply referencing and formatting at a different level. Some of the DOIs are attributed not to the book as a whole on the publisher's website, but to chapters. This book,

41 See `https://www.openbookpublishers.com/`.

42 It also fulfils accessibility standards.

43 One example of such an aggregator is the Directory of Open Access Books, or DOAB; see `https://www.doabooks.org/`.

with its six parts (including introduction, conclusion, and bibliography), would and certainly will, at some point, be attributed six different DOIs by one book distributor or the other. This means that there will be one DOI for the book as a whole and six DOIs for each chapter, maybe even several DOIs for either the book or the chapter depending on the distributor's practice. This redundancy issue is not simply problematic in terms of environmental cost or in terms of efficient referencing, it also makes any use of aggregated statistics futile. If some providers work at chapter level and others at book level, it is impossible to get a clear view on what the overall download activity for a single book is. It would be like adding apples and oranges. Yet downloads are a relevant indicator when it comes to assessing environmental impact as it informs on data traffic.

All the previous considerations concern the distribution of the book via online platforms. These distribution networks provide accessibility for a wide array of people with a comparatively limited, although not totally negligible environmental impact. But as I have shown in Chapter 1, online platforms do not necessarily guarantee a book's accessibility in the future. When considering the long-term accessibility of this book, even the combination of library distribution and Open Access availability does not provide a sustainable preservation, let alone access. Supplying archiving requires one to have a way to store and record the text file (as described in section 1.1.2) on a reliable infrastructure. By the time of writing, Open Book Publishers has a two-step archiving process that is based on the PDF output. It is archived by Portico,[44] a service that supplies only archiving. Access is closed, only to be opened if the primary distributor is unable to provide access anymore — if they cease their publishing activity for instance. A PDF is also provided to the Internet Archive, together with all the links included into it in their form at the time of publication. The Wayback Machine thus provides access to the book itself and to the interlinked material. This twofold solution involving Portico and the Internet Archive is based on external services and is not fully reliable in the sense that these services could very well, at one point or another, be deactivated. Then, the better form of archiving will definitely be the traditional library.

No simple way to archive scholarly books exists that would guarantee long time preservation and access, and all of this at a minimal

44 See `https://www.portico.org/`.

environmental cost. Open Books Publishers has been working towards a more sustainable approach in the context of the COPIM project, together with institutional and commercial partners.[45] Instead of working with a PDF-based output format, COPIM is building an infrastructure that will provide long time archiving of XML-TEI files containing raw text, as well as the document structure, such as sections and subsections, reflecting the overall tree structure of the text. The distributed infrastructure underlying the archiving process will be maintained by a network of actors, including long-established university libraries that can guarantee sustainability. Since I am working in TEI in my everyday editorial work and am familiar with this technology, I provided the TEI file generated from the LaTeX file myself, but the publisher could have taken care of it. This conversion does add to the overall footprint, but it does so from a rather parsimonious language to another parsimonious one, and in the case of this book that has very few features and only text, the process is an economical one. The environmental cost is extremely low when measured against the potential archival benefit.

The archiving repository envisioned by the COPIM project provides sustainability at a low ecological cost by building on existing infrastructures. The libraries involved have a long-standing history,[46] and are not likely to disappear from one day to the next. Relying on a durable infrastructure is only one way of keeping the environmental footprint of this archiving strategy fairly low. Information exchange within the network is also kept at a minimum through the use of completely open and interlinkable metadata catalogues. The praise of metadata and catalogues I have been singing all along in this book will not stop at the end of Chapter 3. If anything, it will become even louder. Standardised metadata and catalogues are not just part of an efficient archiving and distribution process, they are also key to a low environmental impact of access to text.

What is more, since the network is community-driven and not commercial, it saves on such energy dispensers as ad banners on websites and, more generally, environmentally costly features designed to increase business wins. With this minimal energy outlay, it also contributes to preserving data that would otherwise be at risk of disappearing. It is

45 See Community-led Open Publication Infrastructures for Monographs, `https://www.copim.ac.uk/`.

46 See the list here: `https://www.copim.ac.uk/about-us/who/`.

tailored for and by small publishers, who are more likely than not to cease their business long before the partner infrastructures and heritage institutions do. In that sense, it contributes to preserve digital material that would otherwise die with its initiating publisher. The COPIM project is still nascent to this day, and has not yet unfolded its full potential. Yet the rationale behind its creation shows, at the very least, that key actors in the field of access to text are not only aware of the issues at stake but have taken concrete action to tackle them. I can only hope that more of these convergences will emerge and foster a constructive dialogue between publishers aiming at scholarly and digital quality and higher education and cultural heritage institutions in the years to come.

With these different work steps, the distribution and archiving of this book are guaranteed along the lines of what is state of the art in the European context at the time I am writing. While it would certainly be possible to further reduce the environmental impact of the production of the book, maybe also to do so in a noticeable manner, this would involve a major disruption in the writing, editing, and publishing processes. The solution implemented for this book displays a good balance between environmental impact, respect of pre-existing working habits, quality insurance mechanisms, solidity of archiving strategies and speed of the overall publication and distribution process. It remains within the realm of what competitive publishing processes impose upon individuals in the academic system — authors, reviewers, editors and publishers — while modifying otherwise environmentally costly items. It has one foot in the old world of speedy digitisation and availability and the other in what one can only hope will be a new world of reduced pace and production with inclusive access practices.

There remain two dimensions of the environmental footprint of this book to discuss. One concerns advertisement strategies, and the other the way in which user behaviours are to be accounted for.

Distribution strategies include the physical dissemination of book copies (packaging, sending, and delivering) and that of the PDF mentioned earlier, with its dispatch on a variety of relevant portals. But this is only a fragment of the overall dissemination activity of a traditional publisher. Traditionally, publishers would be connected to a network of libraries to which they would send their catalogue of new publications, and they would also present these catalogues at major book fairs.

Open Book Publishers does not engage in this kind of practice: it neither publishes a printed catalogue nor sends its representatives to book fairs throughout the world, having a strict no flight policy. Most publishers have not engaged in such low-energy practices; in these cases, additional layers have to be added to the calculation.

Advertisement strategies developed as early as the publishing business itself, but gained new traction from the early years of the 20th century. From the first textual advertisement appearing in chapbooks to radio and television teasers, the placement of cultural products has evolved together with the means of diffusion and communication. Not only commercial advertisement, but also critical discussion and reviewing has moved from private correspondences and arcane columns to television programs discussing new releases, inviting authors, and professionalising critique in cultural production.

In the digital context of the 21st century, it has become standard to present new books on the publisher's webpage, in newsletters, or on mailing lists. In the last decade, social media has also become a major outlet. To some extent, one could consider the web of intertextual references that is generated in this manner as an overarching intertextuality, but it is important to be aware of the commercial dimension this entails. In the late 19th-century novel *Effi Briest*, the eponymous main protagonist hears that her husband has uncovered her unfaithfulness and her parents rejected her in a letter that the author, Theodor Fontane, purposefully places on a table next to a certain shampoo advertisement. This is interpreted as innovative and ultimately, from today's point of view, positive.[47] But when Netflix productions integrate commercial brands on purpose as a form of hidden advertisement, inciting thousands of teenagers to use a product, listen to a band, eat a candy — or read a book — the embedding of commercial and cultural purposes gains a novel dimension, among others in terms of its environmental footprint. This kind of branding adds to the overall impact, as do all dissemination methods used directly or indirectly. There, too, the sum of the impact is not easy to measure since the advertisement for one product is embedded in a complex cultural context, a hidden advertisement in popular by-products.

In terms of the environmental impact of advertisement campaigns, the most environmentally impactful process is obviously one that would in-

47 See Lyon, *Anzeigen* [77], pp. 385-386.

volve an upscaled campaign that would not attract the hoped for number of readers. The ratio between the number of readers and the deployed efforts among which the environmental production cost can be split is then very unfavourable. The ability to tailor this ratio with regard to commercial success is precisely the type of competence that publishers provide. It requires an in-depth knowledge of evolving commercial mechanisms — but also an ethical view on them. In the context of the climate crisis, publishers will need to add to this competence a sense of the ecological impact of the processes involved, and find viable ways to navigate between contradictory requirements. In this regard, Open Book Publishers remains rather restrained, having no dedicated commercial strategy for distribution. It relies on twitter posts and on the author's network for one part, and on the discoverability that is made possible through the dissemination of rich metadata via meta-catalogues and platforms for the other. There is no major additional environmental asset to be achieved at that level concerning this book.

In addition to production and distribution activity, the assessment of the environmental footprint of this book requires one to also take into account the receiver's end: the activity generated by the readers. Since the book exists as a printed version and an online version, this means considering the readers of both versions of the book. The more infrastructure is shared by readers, the less the impact of the use. Compared to those who purchase a book for their sole use, readers who borrow the book from a library and then bring it back for others to read, for instance, lower the overall impact: the ratio to be calculated corresponds to the part this book represents in the overall stock supported by the concerned library, divided by the number of users. Calculating the impact of access to the digital version of the book is more complicated since it depends on the end devices and the internet connections used by the readers to download, store, and access the book. If they use reconditioned material and a wired connection, the impact will be lower than if they download the book with a 5G connection on a brand-new smartphone. One could imagine that author and publisher could provide recommendations regarding user behaviour, pointing to optimal settings for accessing the text in a thrifty manner. Superfluous energy spending can be circumvented by keeping the download page as simple as possible, avoiding banners, animations, and data tracking of all sorts, as Open Book Publishers does

with its website. But it cannot prevent readers purchasing devices whose environmental production, distribution, use, and end of life cost will skyrocket the overall impact.

This concerns only direct consumers of the book content, and for this book, I can only assume that there will not be no further elements to take into account in the calculation. But in order to be consistent, for a publication that would potentially target a larger audience, for instance, it would also be necessary to consider the impact of the intertextuality generated by the book production, that is, not the users of the book itself, but the consumers of targeted advertisement via other media such as the press, TV, movies, etc. This is a point where it becomes difficult to decide where to draw the line. Do I need to add the impact of the Netflix series in which a book is mentioned if I want to measure the impact of its reception? While such providers are environmentally extremely impactful, it would mean entering the domain of popular culture, and including the production of cultural artefacts that are shared by a very wide array of the population, and contributing, to some extent, to the canon of popular culture. What is the environmental price paid for sharing culture at large? The way cultural and commercial interests are intertwined points to the fact that shifts in the cultural canon induced by digitisation will also have to be reshaped by the consequences the climate crisis exerts on the material conditions of human culture.

I do not have many final conclusions to draw from this attempt to reflect on environmentally aware workflows for providing access to text. As long as we are not able to rely on transparent information, only radical disruptions are likely to activate leverages towards a sustainable future.

Yet, the pessimistic observation that initiated my change of perspective on the role of digital media in accessing text can be reconsidered in the light of this small journey through various assessments. Not all is good in digital technologies, and their being embedded in the socio-economic fabric of highly resourced capitalism does not facilitate unselfish practices. But there is little doubt that sharing and steering towards sustainable infrastructures — solutions that have proved effective in modern contexts — can contribute to alleviating the environmental cost of producing, distributing, enjoying, and preserving access to text.