DIGITAL CLASSICS ONLINE

(Im)possible History? Digital Ecology as an Approach to Transmit Memory and Cultural Heritage

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Abstract: Classics constantly endeavour to investigate the links a society builds with its history, memory and cultural heritage. With the development of digital technologies, new research methods, knowledge, and a plethora of data have emerged so as to create an environment with its own mythology and rhetoric, where there is no place for loss. In this essay, the authors question the (im)possibility of writing history in such a digital environment where the credo of dematerialisation and unlimited preservation of data has become the rule. In response, the authors posit the digital environment as not distinct nor distanced from the natural environment, whose resources are limited. Therefore, in order to meet academic as well as public needs, we pledge an ecological approach to a sustainable, reasonable and ethical world to preserve memory and cultural, and natural heritage.

A Promethean dream

Assmann (2011) defines cultural memory as the "outer dimension of human memory".[1] Memory culture is the way a society ensures cultural continuity by preserving, with the help of cultural mnemonics, its collective knowledge from one generation to the next, rendering it possible for later generations to (re)construct their cultural identity. In its efforts to transmit an intellectual, cultural and inherited memory drawn from the past, Classics as an academic field is constantly questioning the links and the *lieux de mémoire* that a society ancient or modern builds with its history – in other words, what is kept to be transmitted as heritage and what is lost.[2] Regardless of their sub-discipline, scholars know that their object of study is only ever a fragment of a whole that has come down to them after going through a history that is not always linear and of which they sometimes know little or nothing. Nevertheless, memory has been distilled through the ages by writing, images, and stones. Nowadays, new technologies could provide new ways for transmitting and keeping memory. 3D models, digital replicas and doubles can ensure the preservation of lost and damaged monuments and artefacts without impacting the original. As elsewhere, technological possibilities have been considerably broadened in Classics: Machine and Deep learning, virtual reality (VR), geographical information systems (GIS), three-dimensional modelling, morphosyntactic labelling (Part-of-Speech tagging), optical character recognition (OCR) have been applied in Classics and more generally in the humanities. These digital developments emerged as soon as the 1950s and opened up the potential for new research and the growth of data. Consequently, the amount of data continually produced brought

1 Assmann (2011), 120–121.

2 As Assmann (2008) stated: "things do not 'have' memory of their own, but they may remind us of, may trigger our memory because they carry memories which we have invested into them, things such as dishes, feasts, rites, images, stories and other texts, landscapes, and other 'lieux de mémoire'". Assmann (2008), 111. The notion *lieux de mémoire* has constantly been enriched and renewed by various fields; see in particular Nora (1984), XVI–XLII and Ricœur (2000). As Jacob (2014) suggests, *lieux de mémoire* go together with *lieux de savoir*.

the need for unlimited storage. Storage and access to data gave the illusion of omniscience since these data could be used in new research producing yet more data. Facing this ever-increasing *continuum*, the fear of researchers focused on the risk of data loss and how to avoid this risk. The research environment became a place where it has become impossible to forget.[3] Arguably, the optimistic horizon of omniscience these technologies promise, hides a quite different and much darker reality: nowadays, we face a massive and sometimes irremediable loss of natural, biological and cultural heritage (material or not), the disappearance of species and ecosystems, knowledge and know-how.

In this essay we deal with cultural heritage: in the Western World digitisation of cultural heritage is presented as the best way to preserve it from natural destruction or human madness and as the best way to give unlimited and free access to everyone, to millions of pages of world literature and to faraway sites.[4] But it raises ethical issues in terms of responsibility and sustainability. Unsurprisingly, an important part of the projects on the heritage of emerging countries is being developed in Western universities, but access to their results is restricted to the local communities where the projects are conducted. Likewise, access to databases created in Western universities requires high-performance internet connections or powerful computers. Consequently, the populations whose heritage, history, literature or architecture are being studied find themselves materially unable to access the data produced. This situation produces a new form of imperialism: “often, the communities that should benefit from such projects cannot access these heritage collections due to barriers created by memory institutions (museums, archive, university).”[5]

The global crisis of human migration due to climate change, war and poverty goes together with an increase in the destruction of tangible and intangible cultural heritage. This has led to the urgent need to deploy digital imaging and modelling as a means of preserving both monuments and historical objects, not only for their preservation, but also as a basis for the preservation of the collective memories associated with them.

Despite the real potential of new technologies in heritage preservation, they nevertheless remain devices serving, in some cases, economic, nationalistic, or even neo-colonial agendas.[6] Considering the example of the digitisation of archives by European universities in African countries, Vinck (2016) mentions the risk of a 'flight of archives' out of the source countries and a reinforcement of the hegemony of the former colonial powers.[7] Therefore, dealing with the heritage of others, even in digital form, should imply considering the meaning of the actions carried out, on accessibility and on the usefulness of academic research for the communities. Furthermore, it should entail considering the language of communication for it to be comprehensible for local populations.[8] This digital divide does

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3 In this perspective, we recall that the right to be forgotten and, more specifically, the issues of digital oblivion are major legislative concerns for our democracies. Thus, the Swiss Confederation, through the Federal Commissioner for Data Protection and Information points out that "le développement des nouvelles technologies et l'utilisation de plus en plus courante d'Internet dans tous les domaines de la vie a accru le stockage des données sur Internet et les possibilités d'interconnexions. Au travers des blogs, réseaux sociaux et autres, les internautes laissent de nombreuses traces sur la Toile. Le droit à l'oubli numérique peut être défini comme la possibilité de maîtriser ses traces numériques et sa vie (privée et publique) en ligne. L'apparition de programmes de recherche et d'analyse toujours plus performants conduit à la constatation que l'oubli – dans le sens d'un effacement complet et définitif – devient souvent illusoire." https://www.edoeb.admin.ch/edoeb/fr/home/protection-des-donnees/Internet_und_Computer/explications-sur-le-droit-a-l-oubli.html (Last access 04.04.2022).

4 For a definition of 'Cultural Heritage', see http://uis.unesco.org/en/glossary-term/cultural-heritage (Last access 04.04.2022).

5 Manžuch (2017), 11.

6 For this remark, we would like to thank Sarah Kenderdine (Ecole Polytechnique Fédérale de Lausanne) for her thought-provoking ideas and insights.

7 Vinck (2016), 129.

8 The aspiration is imperilled by the hegemony of Global English in new technologies.

not only exist between different countries (especially North vs. Global South), but within countries themselves, and it reinforces social divides.[9]

Thus, the Promethean dream of possessing digital technologies capable of preserving everything for everybody and everywhere and forgetting nothing appears to us today as an act of hubris coming from a society that has proven itself incapable of thinking *a priori* the very preservation of its own ecosystem. Therefore, the authors of this essay question this digital environment[10] according to which everything seems possible, where heritage, as well as memory, are purportedly dematerialised, with unlimited storage possibilities, whereas natural resources are not.

Losing to preserve: The paradox of Classics

The question of the loss of information and how to deal with it is probably common to any society, be it ancient or modern. From Antiquity onwards, we have many traces that testify to a desire to preserve and transmit – to varying degrees – the memory of a place, an event or a story. This can be through the building of a sanctuary, a funerary monument, the song of an aede, an inventory tablet or even a calendar system, among many others. These traces inform us about the relationship a society builds with its past, present and future as much as they raise attention to our own practices while questioning them.[11] A good starting point for our discussion could be to recall the proem of Herodotus' *History*:

> "What Herodotus the Halicarnassian has learnt by inquiry (ἱστορίης) is here set forth: in order that so the achievements of men may not go extinct in the memory through time (τῷ χρόνῳ ἐξίτηλα γένηται), and that great and marvellous deeds done by Greeks and foreigners and especially the reason why they warred against each other may not lack renown (ἀκλεᾶ γένηται)."[12]

Observing that human memory is fading away, Herodotus conducts his inquiry (ἱστορία) as a remedy to time. It is, indeed, the whole process of extinction – and not only the result of extinction *per se* – which is meant by the adjective ἐξίτηλος. Herodotus cannot think of preservation without also thinking about the risks of losing. It should also be noted that the adjective ἐξίτηλος is used later in Herodotus' account of the extinction of Eurysthenes' family (5,39: γένος τὸ Εὐρυσθένεος γενέσθαι ἐξίτηλον) supposedly caused by the infertility of the Spartan king's wife, Anaxandridas. In Herodotus

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9 In this context it is perhaps interesting to evoke the 2010 *Manifesto for Digital Humanities*. In this declaration, the digital humanities are encouraged to form an open and supportive field, a community without borders. The following sections are of particular interest: "5. Nous, acteurs des *digital humanities*, nous nous constituons en communauté de pratique solidaire, ouverte, accueillante et libre d'accès. 6. Nous sommes une communauté sans frontières. Nous sommes une communauté multilingue et multidisciplinaire. 7. Nous avons pour objectifs le progrès de la connaissance, le renforcement de la qualité de la recherche dans nos disciplines, et l'enrichissement du savoir et du patrimoine collectif, au-delà de la seule sphère académique. 8. Nous appelons à l'intégration de la culture numérique dans la définition de la culture générale du XXI^{e} siècle." Dacos (2010).

10 With this expression we stress, together with Boczkowski (2021), the need to think about new technologies as a holistic, digital environment. Several labels have been given: 'universe', 'world' and 'environment'. Those terms constantly recur in the media as a quick search on Google reveals, both in French and English ('univers numérique', 'digital universe'; 'monde numérique', 'digital world'; 'environnement numérique', 'digital environment'). Of particular interest in our perspective, is Mathias' use of the adjective 'environmental' to hint at the complexity of a system: "l'expérience des réseaux appelle une constante contextualisation une perception pour ainsi dire environnementale des parcours intellectuels qu'on y déploie." Mathias (2015), 137.

11 As de Romilly (1990) notes, "on dirait que le sens de l'histoire naît, au V^{e} siècle, non pas d'une curiosité pour le passé, mais d'un souci ébloui de l'avenir: la Grèce construit sa démocratie sur l'écriture et sa gloire sur la pierre." de Romilly (1990), 8.

12 Hdt. 1,1. Translated by Godley (1920), with minor adjustments.

the extinction is then conceived of in much the same way when it comes to the loss of memory and the extinction of a generation or a species (γένος).

Vernant (1995) underlines that, in addition to loss, memory presupposes a system of time, archive and orientation:

> "ce que nous appelons la mémoire, les activités qui nous permettent d'avoir prise sur le passé sont des choses qui se construisent historiquement ; pour qu'il y la mémoire, il faut qu'il y ait des systèmes de calendrier assez rigoureux, qu'on ait des points de repère, qu'on puisse noter les choses."[13]

All are parameters on which humankind has leverage. And this is precisely what Herodotus does when he writes things down. It is, therefore, through a singular technology that transmission to subsequent generations is effectively ensured over time. Consequently, does this transmission depend on a particular technology? The Ancient Egean World, when the Greek alphabet was not yet in use, provides information: among the Mycenaeans, Linear B writings mainly consisted of accounting records, inventories, and lists so that the loss of writing technology between the 12/11 and 9/8 centuries BCE, certainly did not result in a complete loss of cultural memory through the Dark Ages.[14]

Turning back to the system of time, archive and orientation Vernant describes: to which extent this still holds in the scope of a digital environment? Since the digital environment is characterised by supposedly unlimited storage capacities and, consequently, by an impossibility to forget, what is the place of the past in such an environment? What reference points for future generations are *lieux de mémoire*,[15] when they are digital and dematerialised?

A system of time, archive and orientation is what the digital environment lacks. In order to bring answers, one should first consider envisioning a life cycle for data underlain by a constant questioning of what is worth preserving or not. In this respect, it is important to emphasise the distinction between data storage and data archiving. It is not only that the former responds to short-term safeguarding of data, whereas the latter aims at preservation over a longer period of time; it is above all that archiving supposes a selection and, conversely, a renunciation. Once again, Herodotus' poem informs us about the operative balancing between the principle of selection on the one hand and that of preservation on the other: based on his research, the Greek historian chooses to celebrate the great and marvellous deeds of the Greeks and the Barbarians and to develop the motives that led them to war. By delimiting his field of investigation in this way, he effectively *renounces* the exhaustiveness of a narrative that is impossible to record in its entirety.[16] In the contemporary academic world, one can rejoice in the ever-

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[13] Vernant (1995).

[14] Godardt / Sacconi (1996) conclude: "au-delà des profondes transformations politiques, économiques et sociales qui se sont vérifiées en Grèce et en Égée entre le second et le premier millénaire, les Grecs, ou du moins beaucoup d'entre eux, ont gardé dans leur mémoire et dans leur foi bien des histoires et des croyances remontant à l'âge mycénien". Godardt / Sacconi (1996), 111, see also Bennett (2014).

[15] Nora (1978) underlines the importance of the act of memory through its 'location' and defines the notion of *lieux de mémoire*: "il s'agirait de partir des lieux, au sens précis du terme, où une société quelle qu'elle soit, nation, famille, ethnie, parti, consigne volontairement ses souvenirs ou les retrouve comme une partie nécessaire de sa personnalité: lieux topographiques, comme les archives, les bibliothèques et les musées; lieux monumentaux, comme les cimetières ou les architectures; lieux symboliques, comme les commémorations, les pèlerinages, les anniversaires ou les emblèmes; lieux fonctionnels, comme les manuels, les autobiographies ou les associations: ces mémoriaux ont leur histoire. Mais faire cette histoire amène vite à renverser le sens du mot pour en appeler de la mémoire des lieux aux vrais lieux de mémoire: Etats, milieux sociaux et politiques, communautés d'expériences historiques ou de générations amenées à constituer leurs archives en fonction des usages différents de la mémoire". Nora (1978), 401.

[16] To a similar extent, when Thucydides articulates his narrative around the only events of the Peloponnesian War, he intends to make them "an everlasting possession" (κτῆμα ἐς αἰεί). Thuc. 1,22.

increasing adherence to the *FAIR Data Principles*,[17] which establish common rules for the curation of research data. In so doing, scholars are encouraged to consider their data not as abstract things inhabiting a so-called cloud, but as organic elements that can be forgotten or destroyed at any time. By the way, it should be recalled that storage space is not as abstract a thing as a cloud: datacenters are hosted in real buildings with real (and massive) energy needs. So are the risks and dangers they face. On 10 March 2021 in Strasbourg, a fire struck the building housing the data center of the OVHCloud company – the French leader in cloud computing: nearly 3.5 million websites were affected and some companies lamented the irremediable loss of their data.[18] Is this example so far removed from the burning of the Library of Alexandria? Within the digital environment, moving from the age of storage to the age of archiving means facing the vertigo of selection rather than being misled by the myth of exhaustiveness. In other words, by "(re)introducing" a historical dynamic one allows past cultural memories to be transmitted in a digital *and* sustainable way, regardless of the technological obsolescence of media. As in any life cycle, we have to accept that loss is necessary. Namely, archiving – with a hierarchisation and concerted selection of data – is to be privileged over unlimited storage: we make this claim in this essay, however transgressive for the digital environment it might be.[19] On these premises, it is a model that is not only viable economically but also ecologically – in the primary sense of the word.

In the digital environment, memory processes tend to go through hardware and software, a terminology that includes a dimension at once material (graphic card, motherboard, computer, server), immaterial (cloud) and textual (script, algorithm). The analogical and digital coexistence of objects of study, or even their mere digital existence presupposes an unprecedented relationship to the materiality (and location) of the memory of the past.

The various monuments, sites and spaces thoroughly (re)created digitally seldom raise the question of what digital environment they occupy, or conversely, what environment is under construction to preserve them. The stakes are high for future generations to appropriate this newly constituted, dematerialised digital heritage. Will they link it to a material reality, whether persistent or already forgotten? It is necessary to discuss the question of how to preserve (I.e. archive) collected data, that is either processed or produced in the course of a research project, and to establish a clear line of demarcation between what needs to be preserved and perpetuated and what, on the contrary, can be left out over time.[20] Whether they will be digital and/or analog, the preservation of *lieux de mémoire* will no doubt depend less on a (supposedly unlimited) storage capacity than on the transmission of knowledge associated with it. As Jacob (2014) notes:

> "les savoirs constituent […] une dimension centrale des lieux de mémoire, car la mémoire se transmet et s'actualise grâce à la reproduction et à la transmission de récits fondateurs, de savoir-faire, de manières de dire, d'une mythologie collective. Les institutions et les manuels scolaires, les musées, les académies, les sociétés savantes, les savoirs de l'archive et de la

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17 *FAIR* stands for *Findable*, *Accessible*, *Interoperable* and *Re-usable*. These principles were established by a community of scholars, librarians, archivists, publishers and research funders called FORCE11 in order to help facilitate the change toward improved knowledge creation and sharing. See https: //www.go-fair.org/fair-principles/ (Last access 04.10.2022).

18 Bidan (2021).

19 Our understanding of 'storage' is opposed to 'archive' which implies a selection. This process of selection for memory (which leads to some loss) is a diachronic process, that could arguably be carried out by present as well as by future generations.

20 While one may welcome the research opportunities afforded by the ever-growing amount of data, there is also concern that their preservation may be based solely on the "just in case" argument described by Smith (2014), quoted extensively in footnote 37. Smith (2004), 588. As will be discussed later, it is not ecologically legitimate to preserve everything, and this is not what archiving is about.

> généalogie, les grandes œuvres historiographiques relèvent des topographies de la mémoire autant que de celles des savoirs."[21]

The argument has two sides to it. On the one hand, digitisation increases manyfold the possibilities for institutions (libraries, museums or universities) to transmit richer, unpartitioned and accessible knowledge.[22] In this sense, it fulfils the role of an intermediary between the specialists and the general public. On the other hand, because the digital environment is constantly expanding, knowledge and know-how are increasingly rejected to the margins. As Bouvier (2016) points out, this is the case with ancient Greek literature: what was "once a significant part of a traditional library, is now an invisible portion of the Web's space."[23] Greek literature may now be an invisible part of the web, because comparatively smaller than the rest, even though it generates profuse publications. As Calame (2006) states:

> "pour nous, interprètes et enseignants, le problème est celui de la lecture et de la sélection, puis de la mémorisation de cette profusion de savoirs accumulés sous la forme textuelle à un rythme toujours plus rapide. Que choisir, que retenir dans cette profusion bibliographique en vue de ses propres travaux, en vue de l'enseignement et de la recherche avec étudiant(e)s et doctorant(e)s?"[24]

At the same time, digital technologies are both the end of a series of developments (papyrus, *volumen*, *codex*, printed texts) and the starting point of an economy of knowledge based on a ratio between memory (or storage) capacity and the speed with which it is possible to browse this memory.[25] This ratio is so firmly anchored that today a search engine like *Google* does not fail to highlight the number of results obtained for a search by indicating the fractions of a second that were necessary to obtain it. In so doing, it concretely marks the difference between computer memory, namely a quantitative, unlimited and infinite memory and human memory – which will of course never be able to mobilise as many resources and as effectively in the way the computer does. It is worth mentioning that computer (but also its French equivalent *ordinateur*) is etymologically and essentially linked to a method of sorting based on a quantitative, *computative* conception of information.[26]

On the one hand, this quantitative approach, and on the other the mobility of knowledge within the digital environment makes it difficult to set up reference points. Therefore, we consider that the movement of reference points supposes a reshaping of what *lieux de mémoire* could be in the digital

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21 Jacob (2014), §7.

22 It can be assumed that digital space as a place of knowledge will lead to a topographical reconfiguration of the traditional places of knowledge. As Bouvier (2016) points out, "thanks to Wi-Fi connection, a small café nearly anywhere in the world may become the access to infinitely richer knowledge than the library of Alexandria could ever have been." Bouvier (2016), 104. The multiplication of these places (café, hotel rooms and public places with an Internet access terminal) should not however make us forget that access to the Internet is, throughout the world, largely unequal.

23 Bouvier (2016), 104.

24 Calame (2006), 9.

25 Drawing on the *Odyssey* comparison of the Sirens, Bouvier warns about the way in which, little by little, search engines, in the apparent illusion of exhaustiveness to which they tend, determine our knowledge: "today we understand the implications of incessantly growing knowledge and how search engines will become determinant and influential in our path through the labyrinth of knowledge. For the navigator, the Siren's absolute knowledge will remain a danger forever." Bouvier (2016), 106.

26 It is a particularly telling example that in the foreword to the *Companion to Digital Humanities*, Busa (2004) provides exclusively quantitative data about his work on the *Opus Thomisticum*. Busa (2004), xvi–xxi. One wonders to what extent this very quantitative approach to information, permitted by the computer, is not subordinated to the question of (economic) profitability; indeed, the perspectives for research, teaching and transmission that computer technologies seemed then to offer appear secondary, if mentioned at all.

environment. Admittedly, the ever-increasing wealth and accessibility of knowledge enriches our studies but, at the same time, drowns them in the digital vastness.

Ecology as a response

Too vast, too fast: the digital environment proves to be a danger for the transmission of knowledge that is based, at least in the humanities, on a long period of research. This statement highlights the need to think of a human-scaled digital environment in which *lieux de mémoire* function as reference points to handle this environment.[27]

It is all the more necessary because digital technologies already pervade every aspect of our lives, and influence our ways of thinking our relation to memory included.[28] Mathias argues that our reality is structured by technologies, machines (computers, tablets, smartphones and many others) to access online resources from everywhere at any time.[29] This state of facts makes the interconnections so worldwide and omnipresent that it is now difficult to think of two separate environments (I.e. natural and digital), but one and the same common environment.[30] Consequently, when it comes to regulations, both environments call for the same, ecological response.[31] Call for digital regulations under the form of eco-actions[32] and digital sobriety have been put forward already in 2008 by GreenIt.[33] Sobriety is, indeed, a term that has since been largely applied to ecology and whose implications have been studied in depth by Flipo (2020): nowadays, the term is trendy as it is also understood in economic logics, as a way to equilibrate use and resources in order to optimize economic growth.[34]

Our opinion is that a digital ecology should rather be a system where all actors and factors evolve, where projects develop, and where technologies support each other, with causes, consequences, and improvements, in a way that is nothing short of organic growth.[35] We have to collectively mind this

[27] A paradox, since the adjective 'digital' has the very concrete sense of 'that can be touched with the finger'.

[28] Bourdeau / Marchand (2015), 130.

[29] What is at stakes, Mathias argues, is "une structuration particulière de la réalité, souvent perçue ou appréhendée à travers des outils informatiques, il est question de la *texture* de notre réel. […] l'imprégnation informatique de nos représentations […] concerne aussi nos pratiques intellectuelles les plus intimes, l'écriture et la pensée, elles-mêmes saturées de l'usage des outils informatiques." Bourdeau / Marchand (2015), 133.

[30] Vinck (2016) goes beyond this argument to question the meaning of a digital civilisation: "avec le numérique se serait constitué un nouveau répertoire commun de manière d'être, de penser, d'agir et de communiquer. Parler de civilisation numérique suppose que cette culture numérique n'est pas le fait d'un groupe social distinct mais qu'elle caractérise l'état technique, intellectuel, politique et moral de toute une société." Vinck (2016), 18. Doueihi (2011) also claims that "l'humanisme numérique serait en train de constituer une nouvelle civilisation." Doueihi (2011), 23.

[31] See also Tomasin (2018), 98.

[32] See Cook (2015).

[33] Back in 2008 principles were stated by GreenIT for a *sobriété numérique* in order to achieve a reasoned and thoughtful consumption of digital tools in a sustainable perspective. See https://www.greenit.fr/ (Last access 04.04.2022), and Bordage (2019).

[34] Flipo (2020). The definition of this very concept and thereto relation are under discussion. Recently, the term 'digital frugality' has been proposed to tackle the insufficient impact of sobriety but it is supported by private companies interested in their own economic growth. For instance, the consulting firm Sopra Steria Next has published a brief analysis of the benefits of a so-called 'digital frugality'. "La frugalité numérique: une stratégie viable? un horizon désirable?", see https://www.soprasterianext.fr/lexploratoire/publications/frugalite-numerique-strategie-viable-horizon-desirable/note-analyse-frugalite-numerique (Last access 04.04.2022).

[35] The idea that it is organic and engendering rather than productive comes from ancient implications of φύσις (*physis*), 'that which grows' and *natura*, 'that which is begotten', on which also relies Latour (2017), 89. It goes together with a digital ontology defined by Palladino (2018), as "le pratiche di rappresentazione della conoscenza in forme organizzate

eco-system, as humans surrounded by it, inhabiting it. It is worth reminding ourselves that, for the Greeks 'environment' might be translated by οἰκουμένη (γῆ): *oikoumenê* (*gê*) 'the inhabitable land' and is based on the notion of οἶκος, 'house'. Incidentally, ecology comes from the same word too: humans and their direct environment are core to this notion. Furthermore, scaling down to human handiness permits comprehension and action.

If the arguments that promote a common ground for practices in order to avoid division, duplication of similar projects and restraints in the availability of data, technologies, and software are not new,[36] the need for more sustainability must be stressed, at all levels: projects, research and data. Digital research needs resources, produces results and new data, useful in short or long term, and necessarily also produces wastes, with impacts on the environment under consideration.[37] In fact, this digital ecology is nothing more than the reasonable use (λόγος: *logos* 'reason') of the resources of our actual environment. This does not mean, however, that technology is to be opposed to ecology, as it has often been thought, but that the sustainability of technology *depends* on ecological regulations.[38]

The consumption of natural resources in the dematerialisation process is considerable and the production of electronic waste is often underestimated. Indeed, it has often been claimed that digital technology makes it possible to save and preserve more documents, monuments or audio-visual archives, as the space for such preservation, is unlimited thanks to the dematerialisation of heritage objects in a digital form. However, as Vinck (2016) points out, this dematerialisation of heritage inevitably results in a digital materialisation.[39] Furthermore, digital archiving requires the creation of more physical storage centres; he also underlines that storage centres with tens, hundreds of meters of computer space require both a power supply and ventilation with an air-conditioning system to cool the servers. The dematerialisation of heritage is, thus, costly in terms of raw materials and energy. As an example, one should remember that the demand for metals has tripled between 1980 and 2010 to produce digital devices, not to mention the human costs and casualties caused by armed conflicts the extraction of these metals involves. In a multidisciplinary monograph, Flipo et al. (2013) showed the impact of digital technology on the environment, in addition to the increase in digital waste.[40] The authors thus highlight that, as it is, digital technology does not allow to develop a clean and ecological economy. The question those debates raise is not if digital technologies are ecological – clearly, they are not[41] – rather, if our actions and conceptions of technology are adequate not with constant growth but in articulations with the infinite promises of the digital technologies in our finite environment. Digital ecology as a science not only in the hands of geographers and sociologists but also of classical scholars and more broadly every inhabitant of earth needs global thinking.

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ed esprimibili in linguaggi comprensibili alle macchine, attraverso la definizione di una stuttura formale composta di entità e relazioni fra di esse." Palladino (2018), 171–172.

36 Steiner / Mahony (2016), 127. However, they are other voices that call for the multiplication of databases and projects so as to ensure the survival of datasets through the obsolescence of software as well as a certain existence in the web vastness This is a further reminder of the need for coordination and concertation.

37 As Smith (2004) notices, "the roles of humanists in building and preserving collections of high research value will become as important as it was in the Renaissance or the nineteenth century. Unlike those eras, however, when scholars could understand the value of sources as they have revealed themselves over time, there is no distinction between collecting "just in case" something proves later to be used, and "just in time" for someone to use now." Smith (2004), 588. One can ask if storing all this material *just in case*–as research potentialities–is really compatible with a sustainable, digital environment.

38 As Latour (2017), points out, "moderniser ou écologiser, c'est devenu le choix vital. […] on continue d'opposer l'économique à l'écologie, les exigences du développement à celles de la nature, les questions d'injustice sociale à la marche du monde vivant." Latour (2017), 63.

39 Vinck (2016), 35–36.

40 Flipo et al. (2013). See in particular the discussion on greenhouse gases, 18–25, and wastes 26–34.

41 Flipo et al. (2012).

Conclusion

In this essay, we have questioned the rhetoric and myths of the Promethean dream of technologies that imply constant expansion and we have foregrounded the limitations imposed by nature: space, memory, transmission and resources. In the end, what does it concretely means for digital Classics? The consequences of digital transmission of heritage are mixed: on the one hand, dematerialisation of heritage ensures remote access, opens up the perspectives for new research, and allows to study artefacts in a given state of conservation. In this case, the digital doubles help prevent any further deterioration: that is the purpose of the numerous digitising programmes in the libraries and archives. For destroyed monuments, digital transmission gives access to a given state in a diachronic or synchronic way. On the other hand, it highlights and amplifies the digital divide. It also challenges the preservation of digital heritage, questioning the space it occupies, and the human, natural, and financial resources it implies. In so doing, it impairs digital sobriety.

Whether events, buildings, or texts, be recorded or not, whether the memory is transmitted or falls into oblivion, the transmission of heritage depends not so much on the sustainability of devices, formats or storage capacity as on the preservation of our natural environment *tout court*: this can be achieved as long as resources are still available and accessible since the digital environment is neither distinct nor distanced from the natural environment. Or else, whom does Herodotus write for, whom do we put up 3D models for, if no future generation is here to see? And if we optimistically consider the point, what is to be transmitted, who is to decide and what is going to go extinct in the memory through time? Herodotus wrote the *Histories*; it belongs to the digital classicist, following in his footsteps, to provide for transmission to future generations and secure reference points in order for them to mould their own memory.

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