Germinating Seeds of Computing Systems (Hopefully) Compatible with Planetary Limits : An "Already-there" Example

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Disclaimer: The authors of this paper are French native speakers. A first version of this text was written in French. The English version that you are reading now has been adapted *from* the French version, *by* the authors themselves (*not* using LLM tools, only online dictionaries where was necessary). The reader will hopefully be benevolent as of the quality of the English language. The French version is available as well.

I. Introduction

The development of digital technologies has always been nourished by a sort of mythology including limitless expansion and minimization of its impacts on human societies and the environment, to the point of making these impacts invisible. An example of this is the infamous Moore's Law, a self-fulfilling prophecy that proclaims that computers will become twice as fast if you wait a relatively short amount of time, and that this will go on "forever". This development is even presented as an irrepressible movement, an absolute necessity for engaging our societies into the desired ecological transition. In this respect, these technologies affect every field of our modern life and can be apprehended, as Ivan Illich defined the term, as some form of *radical monopoly*. At the same time, the materiality of these technologies is largely made invisible, both in public speech (that of partisans or public relations) and more widely in commercials, fictions and imaginaries.

Following the seminal work of Meadows et al. [16], numerous thinkers remind us of the necessity to think of the entirety of human activities to stay within the geophysical boundaries of our world, as well as respecting the great equilibriums of ecosystems. The general praising of digital technologies, be it in the general public media or even amongst academic researchers, is slowly being breached by academic works on the environmental and social impacts of these technologies [15], [20]. Some thinkers, eg B. Stiegler in [22], require that we, as a society, question the omnipresence of these technologies in our lives. In some cases, this questioning goes to the point to ask whether the digital infrastructure should be purely and simply dismantled [5].

In order to investigate the place that digital technologies should hold in a future that would be compatible with planetary limits [19], we ground our reasoning in the typology from the work of M. Deron [6], who identifies 4 different perspectives. On the one hand, we need to identify practices that are globally harmful and need to be abandoned (*ruins*) as well as the imaginaries in which these practices are rooted (*ghosts*). On the other hand, we need to develop new desirable imaginaries (*visions*) that will be encouraged by already-there *seeds*, ie experiences that are taking place today but that already implement these visions. Ruins and ghosts have already been the source of empirical and aesthetics studies. Some of these works have introduced the possibility of repair and transformation acts, as a way to compensate for their negative impacts [14], [3]. Concerning visions, many works in the field of prospective studies already discuss the place of digital technologies in various futures [2] including ones following some form of alternative to economic growth scenarios [7].

The work presented here aims at designing a methodology to help identify, among technical objects already existing today, some that may serve as inspiration for tools that would thrive in a society living within planetary limits [18]. Hopefully, the proposed method will also help the design of new tools in this direction.

We particularly focus on two projects that are developed with an anticipation of a collapse of our western modern societies (see [23] for an introduction to Collapse Informatics). These systems, called CollapseOS and DuskOS are considered to implement a number of ethical values that emerge either from the technical choices made in their design or by the use cases envisioned for them. Note that in the rest of the document, we will use the name DuskOS for describing both projects. CollapseOS is more or less finished, from its creator's point of view and its development is fully integrated into that of DuskOS itself.

The study of these use cases will be performed through a multi-disciplinary approach at the crossroads of Computer Science, Ethics and Sciences and Technology Studies (STS). Studying digital objects allows to analyze the social construction as well as the technical determinism of their development [1]. Ethics brings an important perspective, raising the question of "how well can we do" computers[13]? The reflexivity of ethics studies brings about some knowledge in a more systematic way.

We believe that this work comes under the field of Undone Science for several reasons, that can be linked to the question

of "values" put forward in [9] concerning the done vs undone vs should-be-done or should-be-abandoned scientific research. The first reason concerns the crossing between STS, ethics and computer science mentioned above. The reader will probably feel this is not really "Computer Science". We argue that it is specifically because Computer Science is most often performed without any sociological reflexivity in mind about its ways of creation nor ethical reasoning about its consequences on society and the world in general. The second reason relates more directly to our object of study. With DuskOS, we move away from a dominant imaginary concerning the place given to technology in our societies, both from an epistemological and political sense. From the epistemology point of view, DuskOS contributors chose right from the beginning to place their work in an envisioned society that is clearly out of the dominant capitalo-productivist social tale. And this irrigates the technical choices made in the design of the system. Second, from a political point of view, very early in the discussions about DuskOS (at the time where the focus was on CollapseOS), its designer explicitly stated what he identified as weakness in our political systems and the way technology is being developped. These flaws served as opposition guides for designing the system.

To illustrate this, we can look at the question of systemic risks linked to the development and deployment of a technical object. In the traditional "done" computer science research (both industry and academia), these risks are most often completely made invisible. At the best, they are described as potential impacts that need to be mitigated. In the case of DuskOS, these (at least some of them) are identified from the start and serve as a basis for "design principles" that can be linked to Illich's conviviality. These ethical principals have a direct influence on the properties that are built into the system [4] and then translated into actual technical choices: What programming language to use? What concurrency model to integrate into the system? What software tools should be developed? In which order, with which priority and precedence with respect to each other?

Of course these choices have biases, dead angles. For example, the "low-level" characteristics of the programming models used to build and program DuskOS raise questions if we want these systems to emancipate people, to be "inclusive". Who do they really emancipate? And from what? The goal of this work that we have undertaken with DuskOS (and that we hope to pursue with other tools and objects from a galaxy of alternative software stacks, eg perma-computing [1]), is not to set these systems as new Eldorados. We rather what to rigorously study the conditions under which they emerge, their dead angles, the shift in story telling that they operate, and hopefully clarify if and how they really are tools for a more just, emancipatory and ecologically sustainable society.

Finally, the choice of studying DuskOS is guided by the possibility it offers to stand in a double posture, partly analytical, partly reflexive. This is made possible by one of the authors coming from the field of Computer Science, with abilities to understand the inner details of DuskOS and the justifications brought by its designer to actually making choices about these details, as well a as the other author coming from the field of ethics, with an analytical view over the inception of these choices. All in all, this allows us to finely understand design choices and situate them technically, historically, ethically and sociologically.

All this being said, this is still work in progress, as of the writing of this document.

II. Computer Science, Ethics, STS

A. An analytical and reflexive meeting point

In this work, we propose to study the possibility of digital technologies within planetary boundaries by exploring several dimensions. A first dimension is axiological in the sense that we decide to steer our quest of *a* definition of digital technologies in a normative way, around values that include Illich's Conviviality [12], Gorz's Sufficiency [10] or Hamant's Robustness [11].

From a more practical perspective, this work aims at identifying seeds, ie digital tools that are hopefully compatible with planetary limits. This is not to be thought as a search of exhaustivity but to serve as inspiration for transformation of existing practices.

As an extension of these two axes, we also wish to sketch an ontological reasoning about digital technologies outside of the realm of economic growth. How can we redefine the actual potentiality for existence of this field outside the logic of a capitalist or productivist economy.

B. Tools and methodology

In the context of this presentation, we wish to formalize and debate about the conceptual and methodological tools needed to pursue this analytical and reflexive investigation. We will make a critical analysis of the matrix of conviviality introduced in [4] and compare it to other similar approaches[17], [24]. Using this kind of methods to study a technical object like DuskOS, as well as its usages necessitates to include the material conditions of its existence. Different methods can be used for this purpose, including Life-Cycle Analysis [21] or a version of such LCA that incorporate social dimensions [8]. We strengthen these analytical methodologies by an ethnography of the use case considered. As we will show for DuskOS in the following section, it is important to contextualize the project studied to help understand the technical choices made by its promoters. It is also important to render the human, social and ethical motivations of these promoters, in order to expose the relationship between these motivations and the choices made at a technical level.

III. Application to DuskOS

A. CollapseOS and DuskOS, a technical project

CollapseOS was made public during the year 2019[2], as an attempt for its author (Virgil Dupras) to prepare for the

[1] See https://permacomputing.net/

[2] See https://itsfoss.com/collapse-os/.

collapse of our modern societies. At that time, Virgil Dupras considered this collapse to be inevitable and imminent[3] and he took the stance that '*we need to have a system that can be designed from scavenged parts and program microcontrollers*.' One of his objetives at this time was to define a self-sufficient software stack, allowing to use micro-controllers alone to build applications that would be useful in a collapsed world. He himself recognizes that "*This project is only relevant if the collapse is of a specific magnitude*", ie strong enough so that the current state of development of digital technologies is not possible anymore, but not strong enough so that humans still care about programming something.

A few months later, around the spring of 2022, Virgi Dupras proposed a more complex system, a kind of big brother to CollapseOS, named DuskOS, whose ("*primary purpose is to be maximally useful during the first stage of civilizational collapse*")[4].

CollapseOS and DuskOS can be considered as operating systems in the sense of an software abstraction layer executing directly over hardware. But in terms of functionalities, DuskOS is very far from what a user of modern computers considers to be "minimal": no graphical user interface, no web browser, no office suite, etc. The base tools provided to the user are a text editor, a compiler for a subset of the C programming language. As a matter of fact, Virgil Dupras considers that, contrarily to Linux and Windows that have users, DuskOS actually has *operators* whose competences should be that of a low-level programmer: "*The Dusk operator is someone who's creative, close to hardware, can read a datasheet. Dusk shines when one wants to poke around the hardware without limit*"[5].

The community that gravitates around DuskOS is organized around a public mailing-list[6] and a public source code depot[7]. The latter is essentially nourrished by Virgil Dupras himself, but around 10 to 20 different persons actively contribute to the various topics on the mailing lists, with many inputs being considered with great interest by Virgil Dupras for inclusion into or modification of the system.

B. Investigation methodology

Our investigation methodology relies on an ethnography study of the DuskOS project. It is important to underline of our own positionning in this project. As a computer science researcher and ethics researcher, we have all the way presented ourselves as members of academia, while we see the members of the project as autonomous actors with diverse competences, working on DuskOS out of predominant currents of economic interets (DuskOS is not a paying-for-a-living project, even for Virgil Dupras).

At the same time, we see ourselves as promoters of this project, since we think it ought to be considered as a seed for a desirable digital tool for a post-growth future.

Concretely, following methods from the field of Human and Social Sciences, we have conducted several semi-directed interviews with members of DuskOS mailing list. Outside of its main inceptor, we think it is important to study these interviews to understand: first what motivates people to come, observe and even contribute to this project, and second because what these other persons bring to discussions do influence Virgil Dupras' vision and choices. The mailing list itself has also been subject to a thematical analysis in order to identify technical and social dimensions that are raised and discussed all along the project's life.

We follow the construction of DuskOS, step by step, both from the perspective of technical choices and from the perspective of political or social discourses (one of the first phrase one reads when exploring the project is that "Winter is coming" which in itself is a rather polarized stance). Through our presentation we will expose the motivations and values that push a certain group of people to contribute (or at least "lurk around") a project like DuskOS. We will also propose a framework for analysing the ethical dimension of this project. This framework will hopefully be useful for analysing other existing projects, or helping the creation of new projects, in line with conviviality, sufficiency and robustness.

IV. Conclusion

During this presentation, we propose to discuss the various elements presented above. First, we will expose the ontological dimension of our work, ie through which ethical glasses do we propose to look at digital technologies? In particular, we will draw on conviviality matrix approaches and the alignment of these values with technical properties of the digital objects we study. We will illustrate this through the case of DuskOS.

In a second phase, we will present the ethnographic methodology we use to explore the DuskOS projects and its participants, including our raw material : mailing-list and interviews.

Finally, we will present the results of our analysis, ie a fine grained comprehension of ethical values that are put forward by participants to the project, either explicitely or implicitely. Our analysis matrix will be enriched by these results.

[3]See https://collapseos.org/civ.html.
[4]See https://duskos.org.
[5]Voir https://duskos.org/#operator
[6]See https://lists.sr.ht/~vdupras/duskos-discuss.
[7]See https://git.sr.ht/~vdupras/duskos

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