«DIGITAL ECOLOGY» - HOW COMPUTER SCIENCE AND DIGITAL TECHNOLOGY CAN ACCOMPANY AN ECOLOGICAL TRANSITION

Authors and date

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As you heard in the introductory video of this MOOC, "the IPCC makes it possible for us to be aware of the impacts of our uses on the environment [...]. They use numerical modelling. [...] The models handle a very large amount of data and require a lot of computing power. [...] No digital, no IPCC, no IPCC, no alert".

The work of the IPCC and more generally of climate scientists is often used to assert that digital technology is "part of the solution, not just part of the problem in environmental matters". Beyond this banner, digital tools and uses can work towards the definition and construction of a sustainable world. This is what we call "digital ecology", which is a facet of the "IT for Green" trend[1].

DIGITAL ECOLOGY IS NOT ENVIRONMENTAL OPTIMIZATION

Optimization is one of the main activities of IT. It is sometimes put at the service of environmental concerns, for example by improving the performance of hardware or software so that they consume less energy, by adapting public lighting to uses, by seeking a reduction in the use of inputs for agriculture, by making transport flows and energy networks more robust and efficient, in particular renewable energy, by optimizing the use of objects (computers, cars) by networking them. This is the "smart" trend. Sometimes under the guise of good intentions, these practices often come up against their own energy costs, which are added to the use of traditional means rather than replacing them, the rebound effect (see concept sheet "The rebound effect"), for questionable environmental benefits (see concept sheet "Calculation and estimates of the positive impacts of digital technology for the transition")[2].

THE AMBIVALENT JUSTIFICATION BY MODELLING FOR THE ENVIRONMENT

Mathematical models allow us to understand the world, at any scale, from the atom to the universe. They have been used to understand that global warming is due to human activities, which can change everything about how we see the future and how we behave. Thanks to the collection of large volumes of data and their digital processing that scientists can see the decline of biodiversity and sound the alarm. Mathematical modelling has been what, in part,

has put ecology on a scientific footing. Numerical simulation from models allows us to experiment with solutions, for example in agriculture where it would be time-consuming and costly to conduct a field experiment.

However, this emphasis on the ability to produce a detailed knowledge of planetary limits to justify the beneficial effects of digital technology for the environment ("no digital technology, no warning") can be discussed. While the IPCC and thousands of scientists do use large volumes of data and large amounts of computation to reach their conclusions, it is a bit of a stretch to conclude that we would not be informed about environmental havoc and its causes without the digital deployment that we know today. For example, the physicist Edward Teller alerted the oil industry in 1959 to the dangers of global warming due to CO2 concentration[3]. In 1972 the Club of Rome was already building elaborate and worrying scenarios about our use of planetary resources and its consequences on the future, with much more rudimentary computer tools and without internet. Warnings about global warming already existed in the 1980s, and the awareness of populations may owe as much to political, militant or media actions as to the technological improvement of models.

COMMUNICATE, INFORM, GET INFORMED, ORGANIZE

It is in the disruptive capacity of digital technology to link actors directly on the basis of common interests that the potential of a true digital ecology begins to appear. The influence that social networks have had in democratic movements is also at work in ecological movements. They are used to share information, gather data, democratize access to knowledge, build activist networks. For example, digital applications promote networks of exchanges, donations or loans of objects, the development of short food circuits, local currencies. Databases such as Geoportail provide easy access to data on soil and climate, and participatory databases such as Open Food Facts gather information on food products. Thanks to digital tools, local initiatives are linked and benefit from a common knowledge to which they contribute. Digital tools have also encouraged the development of large-scale participatory science, where citizens participate in the development of knowledge and in particular in environmental assessment.

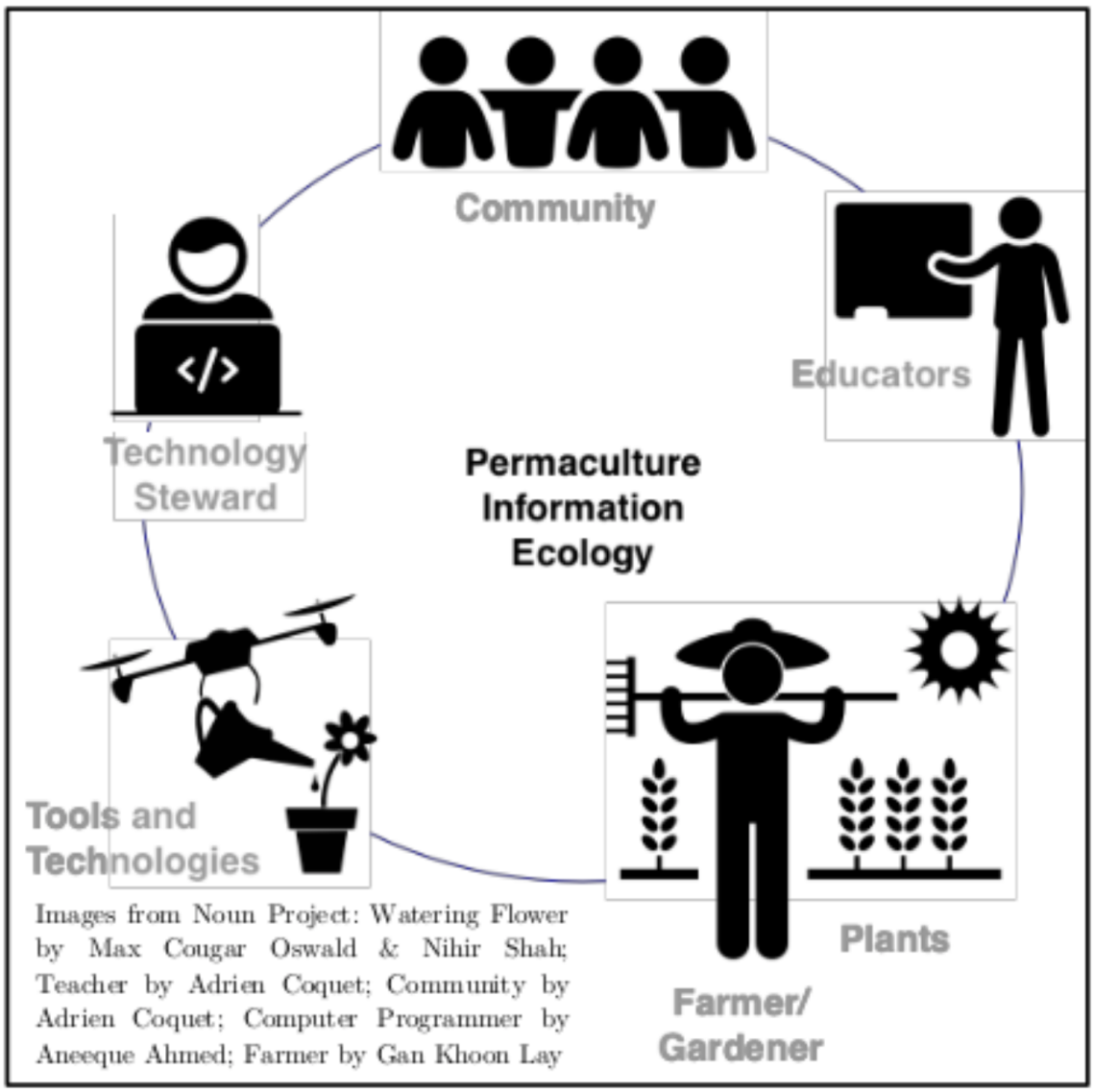
Digital communication tools are also helping to reduce the share of transportation in greenhouse gas emissions. The rise of videoconferencing, telecommuting, telemedicine, distance learning, virtual congresses, allow to replace a mode of interaction sometimes too emitting. The environmental and social consequences of this upheaval have yet to be assessed.

THE ENVIRONMENTAL AND SOCIAL CONSEQUENCES OF THIS UPHEAVAL HAVE YET TO BE ASSESSED.

Digital ecology is also a field of research in computer science and digital technology. Behind communities called "Computational sustainability", "ICT for sustainability", "Collapse Informatics", "Computing with limits", "Environmental Informatics", computer scientists use their knowledge to build the modes of existence of a sustainable world. All these fields are interdisciplinary, and often borrow ideas from anthropology, psychology, sociology,

educational sciences, philosophy of technology, art, music, theater. They are carried by scientists who are often also activists, i.e. bearers of a conviction and an action that goes beyond the epistemological stakes of their discipline. The uses are put forward, rather than the particularities of the computing disciplines. The values with which the tools are designed are integrated "by design", and environmental ethics studies are carried out upstream. Particular attention is paid to the risk of dependence on the tool built, and the possibility of removing it from the landscape if the resources no longer allow it to function. This is the principle of the self-evanescent digital, whose form depends on its own dependence on resources that are not eternal.

For example, computational agro-ecology[4] designs tools and collects participatory databases that facilitate the implementation of productive community food gardens adapted to local terrains and parameters. These tools enhance user autonomy, as they allow non-specialists to access the necessary knowledge, but do not create dependency, as once launched, users can do without the tool.



Computational agro-ecology: thinking about the place of tools in human activities and relationships

CONCLUSION

Just as there is sometimes an ethics "by design" in the making of tools, which consists in making explicit the values with which they are built from their conception[5], digital ecology differs from attempts to green certain technologies by taking into account an explicit and thoughtful philosophical project that does not evade the question of impacts and responsibilities: why and for what kind of world is a tool introduced into a device?

NOTES

1. The question of nomenclature and translation is not insignificant. The "green IT" trend, which describes attempts to make the digital industry itself more sustainable, is distinct from "IT for Green", which is the construction of tools that could participate in the ecological transition. So you

can't say "green digital", which is ambiguous, and "digital for green" is laborious. I found "digital ecology" on a WWF site. I put here "digital ecology" to use the same idea and to stick to the habits of this mooc. This translation has the advantage of emphasizing ecology, and this reversal of perspective translates the main purpose of this article: digital technology can accompany a transition if it is conceived in the context of an ecological need. We can therefore find this use more restricted than "IT for Green", because it allows the criticism, by showing its interest, and also its risks and possible drifts. The same reversal is present in Bill Tomlinson's book, Greening through IT, Information Technology for Environmental Sustainability, MIT press 2012. ↩

2. I leave aside the decidedly fraudulent postings that highlight the environmental cause in their digital activities that obviously work against it, such as some companies touting the use of the cloud as an environmental gain, or such as the MIT Media Lab and its "food computer", which allows plants to be grown out of the ground in computer-controlled environments, see for example "Eric Tannier. L'informatique les pieds sur Terre. Interstices. 29/09/2020". ↩
3. Steve Hanley. Edward Teller Warned Oil Industry About Carbon Dioxide & Climate Change 6 Decades Ago. CleanTechnica. 01/2018. Available at cleantechnica.com ↩
4. Juliet Norton, Information Systems for Grassroots Sustainable Agriculture, Ph.D. dissertation from the University of California, Irvine ↩
5. This is the trend of "value sensitive design" ↩