stomp

Sustainable
Tools for
Online
Music
Practices

the
green
room

A practical guide
for musicians

Foreword

This guide was researched and compiled between February and October 2023. Around 30 professionals contributed to this project through semi-structured interviews. Although not all the people we met are cited by name in the pages of this document, it is based on all their thoughts and analyses. We would like to thank them all warmly for giving us their time and sharing their ideas. It should be noted that several organisations and companies, including streaming services, did not respond to our requests.

The list of people interviewed is available in **the appendix**.

A new, a vast, and a powerful language is developed for the future use of analysis, in which to wield its truths so that these may become of more speedy and accurate practical application for the purposes of mankind than the means hitherto in our possession have rendered possible.

Ada Lovelace

If you wish to reference this guide: *STOMP – Sustainable Tools for Online Music Practices, A Practical Guide for Musicians*, The Green Room, 2023.

The links mentioned in this guide are for information purposes and do not constitute affiliate links.

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MUSICAIRE — AN INNOVATIVE RECOVERY FOR EUROPE

Music moves Europe

cNM Centre national de la musique

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Introduction

Responsible for 3 to 4% of global greenhouse gas (GHG*) emissions according to various recent studies, digital technology represents a source of environmental impact as much as a tool that is now essential to the functioning of the entire musical ecosystem and its creative value chain, but also to the promotion of music and the inclusion of audiences. While the live sector has begun to adopt virtuous practices and is engaging in various approaches and projects to measure and perfect its trajectory of mitigation and adaptation to climate change, the environmental impact of practices linked to digital musical is too rarely addressed. People working in the music industry today are also subject to contradictory demands, caught between encouraging digital acceleration and the need to take part in the ecological transition.

Professional approaches to measuring the environmental impact of the digital music ecosystem are rare, and academic research dedicated to this subject can currently be counted on the fingers of one hand. They will be referred to throughout this document. This project comes at a time when professional organisations and European streaming platforms are fighting against the proliferation of fake streams – which already account for 1 to 3% of streams in France[1] – and when Spotify is finding itself obliged to purge its databases of songs written by artificial intelligence (AI). It is ironic to note that these pieces written by robots have been mostly "listened to" by… robots[2]. These streams, which haven't benefited anyone, have a real impact on the environment, the extent of which we currently are not able to measure.

"You can't start touring in Iceland without leaving the island, so I know a lot of people that are like "it's going to be hard for me to be green when I have to start by flying""

Anne Dungal, Events team for Iceland Airwaves & Sena Live, founder of OK Agency

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1   (i.e. 1 to 3 billion listens)

2   **https://arstechnica.com/information-technology/2023/05/spotify-ejects-thousands-of-ai-made-songs-in-purge-of-fake-streams/?comments=1&comments-page=1**

The European perspective

The European Green Deal, a set of policy initiatives charting a path towards climate neutrality for the continent by 2050, highlights the need for a holistic, cross-sectoral approach in which all fields contribute to this ultimate goal. Within this framework, it recognises the essential role of digital transformation in achieving a resource-efficient, carbon-neutral and resilient world. At the same time, one of the Commission's priorities for the 2019-2024 period is a Europe that has adapted to the digital age. But when we look at investment funds and financing, these are more readily directed towards digital innovation than towards its 'greening' and, in the cultural sector, few proposals encourage the harmonisation of issues linked to digital technology and its environmental impact. We can even identify numerous contradictions, even contradictory demands, within the public financing of the sector offered by the various European programs and in that proposed by individual states. This was particularly the case during the various recovery plans put in place following the Covid-19 health crisis.

In April 2022, the report *One Voice for European Music – A Unique Voice for European music*[3] highlighted the importance of digital in contributing to the sustainability of the European music industry "particularly in terms of inclusiveness, diversity, ecological transition and fight against climate change", while also highlighting its negative impacts, insisting on the fact that digital practices are "currently the main factor in the increase in greenhouse gas emissions from the sector". The report recommended better awareness among stakeholders in the industry of these issues, the highlighting of various existing initiatives at European level and the development of tools and systems which would enable the sector to strengthen its capacity to "invest in models of innovative and sustainable creation, distribution and monetisation, in line with the EU's ambition to become the digital champion of tomorrow."

The *Voices of Culture - Culture & Creative Sectors & Industries driving Green Transition and facing the Energy Crisis Brainstorming* report[4] of September 2023 calls, in a section devoted to digitalisation and virtualisation, for greater transparency from digital players and for reflection by the cultural and creative industries sector on its quantitative and qualitative needs in terms of digital content.

3 https://onevoiceforeuropeanmusic.eu/wp-content/uploads/2022/04/EN-WG-REPORTS-2.pdf
4 https://voicesofculture.eu/2023/04/06/culture-and-creative-sectors-and-industries-driving-green-transition-and-facing-the-energy-crisis/

It is interesting to note that the links made between digital technology and environmental impacts and the resulting recommendations come from the involvement of stakeholders in the sector, brought together in dedicated working groups. Conversely, at Commission level, the *Greening the Creative Europe Program*[5] report from December 2022 almost entirely omits the question of the impact of digital technology and does not make specific recommendations.

In reality, the environmental implications and ecological costs still don't seem to be real considerations for digital players working in the music industry in Europe, where the "sky's the limit" approach seems to be more the norm than digital sobriety or the renunciation of certain practices.

However, the 2022 *Cultural Mobility Yearbook*[6] from the On the Move network dedicated to digital mobility demonstrated that if "online" was a country, it would have been the largest destination for mobility in 2021. However, this situation, which is linked to the circumstances of the health crisis, has given rise to practices, whether hybrid or online, that are becoming more established, particularly those that lead to more ecological working methods.

It is in this context that the **MusicAIRE** call for projects was launched at the beginning of 2022, supported by the Creative Europe programme, aimed at helping the European music sector to meet the challenges posed by the pandemic while promoting the sustainability of the ecosystem through a "green, digital, fair and resilient" recovery. If the call made it possible to respond to only one of these recovery objectives, we developed the STOMP project by taking advantage of this opportunity to simultaneously address the environmental and societal issues relating to digital practices and usage in the music sector, by focusing our attention on the people it concerns most: musicians.

5   European Commission, Directorate-General for Education, Youth, Sport and Culture, Kruger, T., Mohamedaly, A., Muller, V. et al., *Greening the Creative Europe Programme – Final report*, Kruger, T.(editor), Mohamedaly, A.(editor), Muller, V.(editor), Rodriguez, A.(editor), Feifs, T.(editor), Buiskool, B.(editor), Publications Office of the European Union, 2023, **https://data.europa.eu/doi/10.2766/625636**

6   **https://on-the-move.org/resources/library/cultural-mobility-yearbook-2022**

The project

With STOMP, we wish to draw the attention of the international professional and academic communities to the environmental impact of digital usage and practices in the music sector. The project also aims to question the role that artists wish to, can, or must play, in efforts to reduce the environmental impact of music, in order to contribute to systemic change.

Here we offer an overview of the issues, academic research and professional approaches that are being undertaken to fill this blind spot that digital has become in the transition of the music sector. We also identify concrete avenues and tools, as well as recommendations at all levels of the musical ecosystem, for integrating digital music into any moves aimed at reducing the sector's environmental impact. The guide focuses particularly on helping musicians who wish to implement a responsible and sustainable digital strategy by providing them with the knowledge, tools - where they exist - and techniques aimed at reducing the environmental impact of digital usage and technologies.

The project was shaped by the responses of around 60 artists to a questionnaire, available in English and French, asking about their professional digital practices, which was circulated between 4th April and 16th July 2023. It was enriched by the responses of around thirty European players from across the music sector - from artists to professional organisations, as well as labels, managers and digital service providers – with whom we conducted semi-structured interviews. These interviews in French or English were carried out in person or via videoconference between 9th March and 9th August 2023.

This document is structured an assessment of the current state of play, a "guide and good practices" section and four contributions from commissioned authors and researchers who provide their analyses of the situation. The tight time frame in which this project was carried out did not allow us to be exhaustive. Our aim is to start a conversation within the musical ecosystem on the largest possible scale. Part research, part advocacy and part practical guide, this document was co-conceived by the teams of The Green Room and Pikselkraft in accordance with eco-design principles:

The Green Room

Faced with the climate emergency and environmental crises, the Green Room association has been working since 2016 with musicians, technicians and professionals in the music and culture sector around issues of mobility and sustainable practices, and carries out assessments, awareness-raising programmes, training and operational studies on issues of ecological transition in the sector.

The Green Room supports venues, communities, networks (regional, national, European and international) and is associated with or leads various European cooperation projects. The association also regularly makes presentations at trade fairs, networking meetings, conferences and professional events in France and internationally on the theme of "environmental and societal change in the music sector".

https://www.thegreenroom.fr/

Pikselkraft

In response to digital exclusion and pollution, Pikselkraft has specialised in user-friendly web and digital eco-design. With the desire to develop a more sustainable digital world, Pikselkraft carries out website audits, runs training courses and develops eco-designed sites, with the aim of imagining desirable digital futures.

https://www.pikselkraft.com/

This guide has been eco-designed and particular attention has been paid to its digital accessibility.

For more information on the eco-designed aspects of the site, please visit:
https://www.thegreenroom.fr/en/news/how-to-make-a-sustainable-website

How to read this practical guide
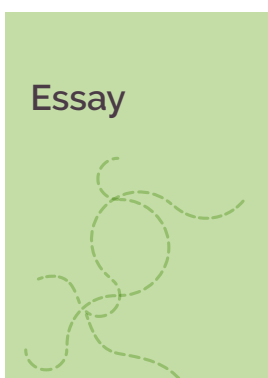
We strongly recommend reading the **State of Play** section first to understand the context and need for this practical guide. Understanding the digital issues and the problems relating to this sector is often the starting point which allows us to make the necessary effort to change our habits. This guide calls for changes in our digital usage. In computing, we quickly become accustomed to certain uses (interfaces, shortcuts, spatial logic) even if there is a better solution, because any change engages a natural reluctance which requires an effort to adapt. This is why the **Established Practices** section is organised in order of the ease with which virtuous habits can be acquired. In addition to highlighting ways of rethinking certain behaviours, it will also aim to create links and highlight different initiatives and prospective approaches. Many collectives and associations are in fact ready to support users in making these changes. Collective awareness is necessary if we are to succeed in the ecological transition. This is also a particularly important factor in the field of communication tools. It is also essential to remember that individual actions are not enough, and that collective and systemic effort is essential to achieving a critical mass and convincing institutions to support these developments and have a genuine impact, one which is beneficial to all. The last part, entitled **Looking Forward**, makes an initial assessment and offers recommendations that can be taken up at different levels of the sector. Finally, **four essays** punctuate the document, in order to provide different perspectives on the state of play and outline what the future of digital technology in the music sector could look like.

Technical terms and abbreviations are defined in the Glossary at the end of the document. They are identified by an asterisk * when you come across them in the text

The state of Play

Digital today

Digital technology occupies such an important place in our society that the European Commission has made it a priority alongside the ecological transition[7]. But is the coupling of ecological and digital transitions feasible? Digital technology already represents 3.5% of GHG* emissions worldwide. It is above all the forecast of a growth of 5% per year in its electricity consumption which leads us to doubt its role as a "solution" in the fight against the socio-environmental crisis. However, estimates and orders of magnitude of digital consumption are difficult to quantify, largely because of its complex structure and its multiplicity of uses.

However, a more quantifiable aspect is the materiality of digital technology. Often presented as being dematerialised, like the much-referenced *cloud**, the reality appears to be very different. In France, in 2022, ADEME and Arcep estimate that 20 million tonnes of waste are produced per year over the entire life cycle of electronic equipment. This equipment is the result of ever-increasing extractivism which has a significant impact on biodiversity, soil and groundwater, to such an extent that it is predicted that humanity will extract as much ore in the decades to come as during its entire history. It is important to note that electronic devices are the primary source of digital pollution. The demand for the rare metals needed for the proper functioning of devices, and by extension for the societal model that we are currently developing, is constantly increasing, while levels of recycling remain very low. The need for rare metals, which are necessary for keeping pace with the growth of digital technology, also risks not only causing problems because of the limited stocks available, but also creating tensions between the growing sectors which need these materials (digital, renewable energies, electric cars and batteries). The impact on humans is also often underestimated. So, for example, the United States' transition to electric vehicles could require three times more lithium than is currently produced for the entire global market, leading to water shortages, the hoarding of indigenous lands and the destruction of ecosystems within its own territory and beyond its borders, exacerbating environmental and social inequalities[8]. In 2025, the battery sector (which includes those in our phones) is on course to represent more than half of the global lithium market demand. These resources are at the heart of industrial and economic interests, increasing the importance of digital technology for the economic growth of states.

The dominant role of digital technology in the acceleration of our societies has changed many of our habits. For example, was it possible to have such a marked increase in tourism without the rise of online reservations? One of the promises of digital technology was that it would connect us without the need for travel, particularly in a professional context. However, just like tourist flights, business flights have only increased[9]. All these innovations do not make old habits disappear. Even though their importance is undoubtedly waning, there are still travel agencies and we are now seeing an overlapping of structures and uses.

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7   **https://commission.europa.eu/strategy-and-policy/strategic-planning/strategic-foresight/2022-strategic-foresight-report_en**

8   Jenni Monet, *Green colonialism : Indigenous world leaders warn over west's climate strategy*, The Guardian, 23 April 2023
    https://www.theguardian.com/world/2023/apr/23/un-indigenous-peoples-forum-climate-strategy-warning

9   World air passenger traffic evolution, 1980-2020 – Charts – Data & Statistics. IEA.
    https://www.iea.org/data-and-statistics/charts/world-air-passenger-traffic-evolution-1980-2020

In this context, our software requires ever more power. Computing functioned on the basis of Moore's "law" which states that for the same price, the number of transistors in a microprocessor doubles every year, which results in a gain in power, miniaturisation and a reduction in price. However, even though this law has no longer held true since 2015, software development does not seem to have taken this physical change into account. According to a *GreenIT* study, the Windows 10 and Office 2019 pair require 171 times more RAM than Windows 98 and Office 97 required 20 years earlier. However, our usage remains the same and this overconsumption is sometimes to its detriment. For example, Windows and Apple are increasingly integrating data collection and advertising into their products[10]. This phenomenon, associated with other practices, contributes to overconsumption via different processes of planned obsolescence (technical, indirect, psychological), according to a pure logic of infinite growth.

"Software is getting slower more rapidly than hardware is getting faster"

Niklaus Wirth, Wirth's Law

It is also essential to make the connection between social justice and a desirable digital future in order to oppose this kind of commercial practice since one is inextricably linked to the other, just as in the fight against climate change. The digitalisation of our society leads to ever-increasing digital exclusion, which results in ever more people being left behind by an increasingly disabling problem (access to public services, security, job searches etc.). This omnipresence of digital technology also has other effects on our societies and numerous studies demonstrate the negative impact of digital technology on democracies[11], education and health, not forgetting its geopolitical influence.

REAKDOWN OF THE DIGITAL SECTOR'S CARBON FOOTPRINT IN 2020

OUR DEVICES
79%

NETWORKS (FIXED ET MOBILE)
5%

DATA CENTRES
16%

ON AVERAGE, A FRENCH PERSON GENERATES

301kg/year of waste

949 kg/year of resources used
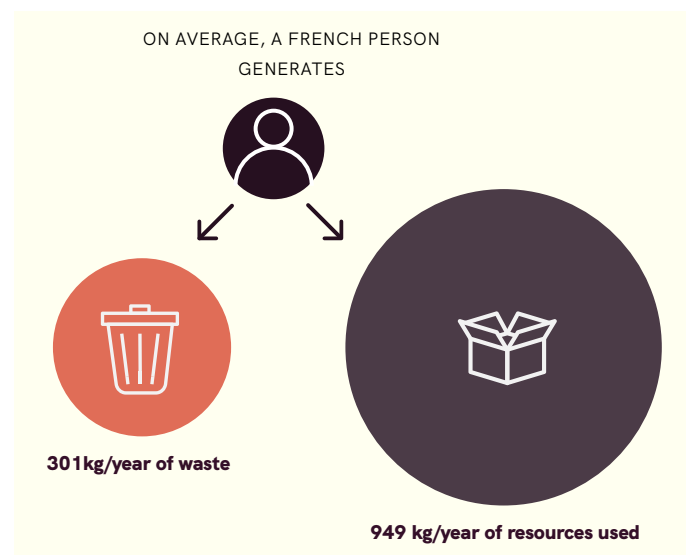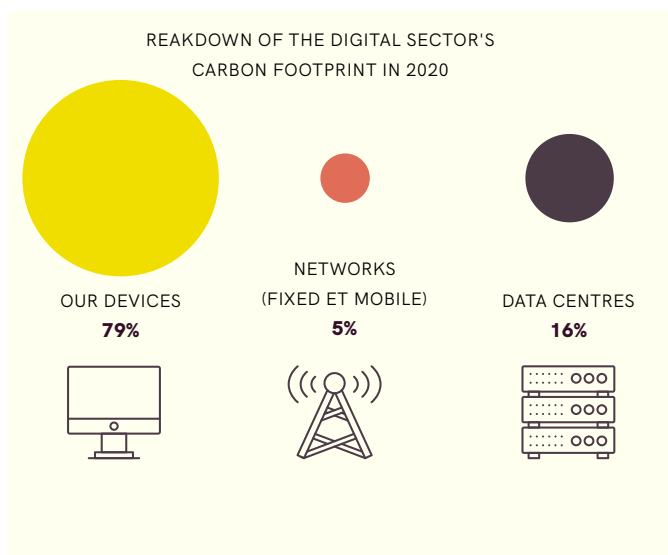
10   noyb.eu, 23 years of illegal data transfers due to inactive DPAs and new EU-US deals and Data transfers **https://noyb.eu/en/project/eu-us-transfers**

11   Zuboff, S. (2019). The age of surveillance capitalism: the fight for a human future at the new frontier of power (First edition). PublicAffairs.

WITHOUT ANY ACTION TO REDUCE IT, THE CARBON FOOTPRINT COULD ALMOST TRIPLE BY 2050, AND ENERGY CONSUMPTION COULD DOUBLE.
EVOLUTION OF
4 ENVIRONMENTAL IMPACT
INDICATORS OF DIGITAL
TECHNOLOGY
(FULL LIFE CYCLE)

+200%

+150%

+100%

+50%

+187% carbon footprint
+179% resources used*

+79% final energy consumption

+59% consumption of metals and ores

+45%
+38%

+14%
+4%

2020   2030   2050
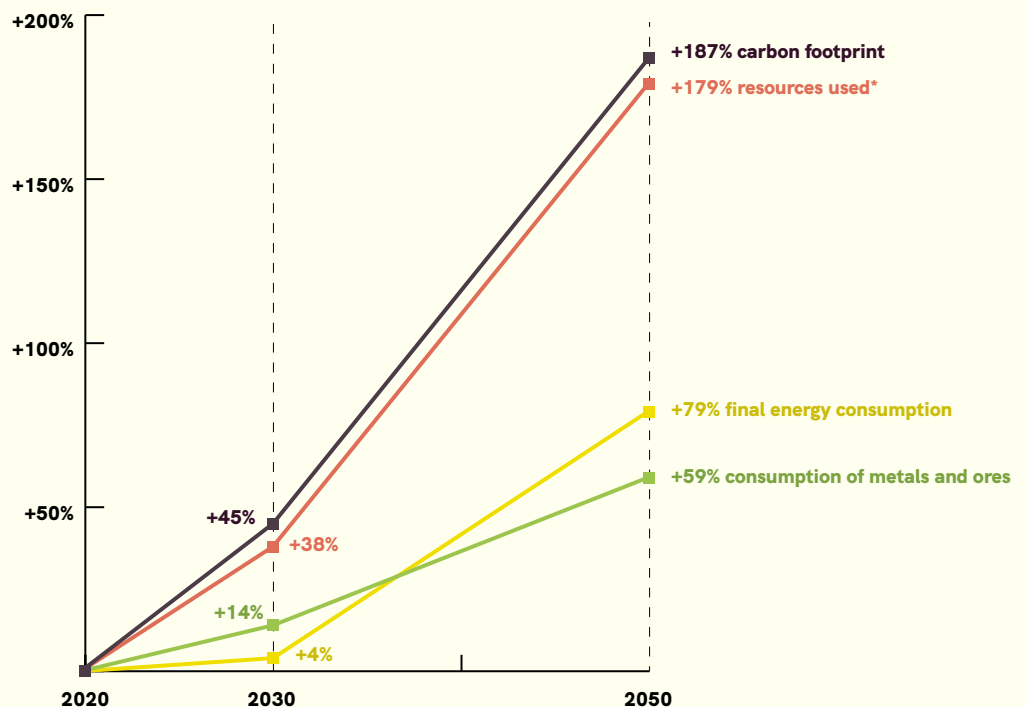
*MIPS definition, taking into account the materials used, biomass, mechanical or erosive earth movement, water and air.

All these factors show how essential it is not to neglect our usage and its consequences. Added to this is the fact that this usage always require more devices. This renewal is mainly due to a digital commercial logic which pushes for over-use, over-consumption and obsolescence. This is not necessarily an individual choice and we are often the first to suffer from the lack of durability of devices. Thus, renewing or changing a mobile plan often encourages the purchase of a new smartphone.

We have already produced a considerable number of electronic devices, and an increasing number of studies denounce digital technology as a waste of materials, resources and time. Digital technology, however, retains its virtuous image among decision-makers, as a tool for facilitating the ecological transition. Few efforts are made either on the part of public services or designers to exercise restraint, contrary to what we can observe in other sectors

(transport, construction). Notions of restraint or even relinquishment remain alien to current discussions about digital technology. We see that our uses continue (browsing a site, listening to music, watching a video, writing, etc.), while the power required for these same uses continues to increase. Despite these alarming findings, it seems that we can reverse this trend collectively, for example by keeping our devices for longer. While this change can start at the individual level, it is essential to bring about change at a systemic level and in terms of regulation, a subject to which we will return.

This dynamic of incessant digital growth is propelled by monopolistic companies - GAFAM: Google, Apple, Facebook, Amazon, Microsoft, but also Netflix, Spotify, AirBnb, Uber, etc. - who also benefit from it. Concentration in this sector is currently having a detrimental effect on the ecological digital transition, despite efforts to

conceal this reality[12]. It is difficult to grant any credibility to these digital giants, particularly given the numerous scandals they are involved in (involving waste, people's private lives, working conditions, tax optimisation, surveillance capitalism*, etc.). An opportunity therefore presents itself for imagining and implementing different digital technologies, free from their enforced uses by large groups and institutions. Technically speaking, this would appear to be possible and will be discussed in this guide.

However, we must not forget the key role of institutions, which are not acting to curb this excess. Currently, states are encouraging a forced march towards the digitisation of our societies and our habits (online education, digitisation of services, telemedicine etc.[13]). This choice is often made to the detriment of the deployment of desirable, democratic and humane digital technology. We are not allowed to choose our digital future. The fight against obsolescence, the right to repair and the protection of privacy require legal support to be applied on a large scale. As with the fight against climate crises, our individual actions are not enough. This guide offers individual solutions addressed specifically to the needs and uses of digital technology by musicians, always accompanied by collective action that is useful for the entire sector, in order to reach the necessary tipping point for a paradigm shift that will involve education, and which must be supported by regulation.

We also discuss new technologies in more detail, including NFTs, the metaverse and artificial intelligence, which present the same structural problem as previous digital innovations. They are pushed by the same individuals and companies that brought about the unequal transformations of digital technologies (GAFAM, monopolies, exploitation, 'Uberisation'). It is necessary to understand the challenges associated with these technologies to grasp the risks and opportunities they represent for the music sector.

For a number of years now, digital technology has been attracting criticism and its deployment has been increasingly questioned. Alternatives to commercial digital technologies are being proposed and developed. Different terms exist to describe this phenomenon, sometimes with different roles and objectives: digital responsibility, digital eco-design and sobriety, *Green IT*, *Tech for Good*, desirable digital, digital conviviality, *low-tech*, *permacomputing* and technocriticism. These movements have emerged from different cultures and embody varied responses to the issues mentioned above. It is important to note that some of these movements are not immune to being co-opted by greenwashing, and that it is always necessary to question new approaches. Their ambitions are essential in responding to environmental issues and display an awareness of the subject that has guided our research and our recommendations.

> We will lean towards using terms like **sustainable or user-friendly digital technology** rather than digital responsibility. Stemming from our research, this choice arose while we were carrying out this project. We think that the term digital responsibility, or responsible digital, is too associated with the possibility of greening current digital technologies without questioning the models themselves. The 'responsible' aspect currently avoids any political and societal questioning of digital technology, which is precisely the aim of this project.

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12   Aiming to Achieve Net-Zero Emissions - Google Sustainability. **https://sustainability.google/operating-sustainably/net-zero-carbon/**

13   A Europe fit for the digital age (19 février 2020) **https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age**

What conversations are we having in the music industry?

"If at any single level people say that it is not their responsibility, we will not succeed."

Anne Le Gall, co-founder and general delegate for TMN Lab.

Digital tools, and the new technologies resulting from them, have opened up a considerable field of possibilities in terms of creativity, discoverability, distribution, relationships with fan communities, and value creation in the music sector. However, we can see a paradox in the fact that these new horizons open to all were quickly confronted with the logic of concentration apparent in the physical musical world, and which was reproduced in these cases. While it has never been easier to speak to an audience using digital tools, it has never been more difficult to make yourself heard.

As with other economic sectors, the rise of digital technology in career strategies and its use by the musical ecosystem have not been accompanied by a systemic approach to measuring environmental impact. Data relating to energy consumption or the extent of GHG emissions produced by these new services are unavailable or very fragmented, for two reasons: most often because they are simply non-existent, due to the failure of players in the ecosystem and their digital service providers (for Digital Audio Workstations (STAN/DAW[14]), ticketing, marketing, storing and sending files, social networks…) to take action to measure them.

But it is also the case that the main players, when they do measure their impact, do not make this data public, or do so in an unusable or unverifiable manner, as is the case for *Spotify*[15] or *Universal Music Group*[16]. Vincent Lostanlen, research fellow at the CNRS, affiliated with the Nantes Digital Sciences Laboratory (LS2N) and guest researcher at the Music and Audio Research Laboratory at New York University, demonstrates this in his article devoted to the ecology of digital music[17], which constitutes one of the rare academic research papers that we have been able to find on the subject:

"So, the GHG emissions declared by Spotify in 2021 include 81 tonnes labeled "end use" and 46 tonnes labeled cloud (and again, surprisingly, 100 tonnes for marketing) without us really knowing what these categories cover. This is why we must remain critical of a commercial statement from Spotify such as "we attribute the increase in our GHG emissions to the improvement of our calculation methodology, the growth of our service to new markets, and (to) a greater number of employees and monthly users[18]". When environmental accounting is carried out with such little precision, it cannot claim the status of causal explanation."

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14   DAW = Digital Audio Workstation
15   Equity & Impact report 2022, Spotify pp. 10 à 16
16   Universal Music Group annual Report 2022 pp. 143 à 148
17   Lostanlen, V. (2023) « Écologie de la musique numérique, mesurer les flux pour déverrouiller les choix » *in* Musique et données, de la recherche aux usages, CNM éditions, Paris, p.14
18   Equity and impact report 2021 », Spotify

This failure to produce data or the absence of transparency in its disclosure, in contrast to the steps taken by those involved in live entertainment and particularly festivals[19], contributes to the lack of visibility on the extent of this impact, and to the maintenance of a harmful status quo.

> **"Apple and probably Google and Amazon also don't want you to speak to them because they don't want to have anything said about what they're doing other than the press releases that they put out [...] the easiest way to avoid a conversation is to be unable to find someone to talk with."**

Peter Quicke, former co-CEO, now Chair of Ninja Tune, co-founder of Music Declares Emergency, co-founder of Climate Action Group, member of Impala's sustainability committee

The collection and communication of this data is imperative to enable political and professional authorities to implement an effective reduction strategy for the sector. Within this trajectory, the weight of audio and video music streaming attracts all the attention, as well as all the frustration when it comes to transparency. This is all the more necessary as it hinges on new forms of accounting, with methodologies that are imperfect and still being developed, as Vincent Lostanlen indicates[20]:

"an investigative approach aimed at quantifying the impact of music streaming in physical units (volume of matter moved, electrical power, quantity of GHGs) faces uncertainties of all kinds. For the most part, the ecological accounting of today's music remains to be invented."

Musicologist Kyle Devine published Decomposed, The Political Ecology of Music in 2019, where he explores the history of the materiality of recorded music from its origins to the present day. The author relates the difficulties encountered in his investigation, during which it was easier for him to collect data on the manufacturing of records and cassettes than for streaming:

"We can know that a cloud server requires "4000-volt DC submarine cables, 96 tonnes of batteries, thousands of litres of diesel, millions of kilometers of cabling down to the last kilometre" and an electricity bill that "easily reaches five figures" every month. Yet database providers and streaming services are guarded when it comes to the details of their true energy consumption, which makes comparison with previous formats difficult. [...]
How does the current proliferation of digital playback devices compare to the manufacturing of 13 million radiophones in 1941, which required 10,500 tonnes of copper, 280 tonnes of nickel, 2,100 tonnes of aluminum and 70,000 tonnes of steel? How can we establish solid bases for these comparisons?"

The author also highlights the fact that the confusion between the notions of digital and immateriality is a rhetorical trap that allows us to ignore the concrete reality of the ecological and social damage in which the streaming industry is complicit, while it remains impossible to analyse its extent.

"The interesting thing is that the music industry, because of the way that digital music provision developed, doesn't have control of the digital music economy in the way that you would expect it to because they don't own the delivery systems, the platforms. [...] So it cannot demand, it can't action specific behaviour within the DSPs because the DSPs don't belong to it. And that power imbalance, if you compare it to the old physical kind of recorded music industry where of course there were third party distributors and the shops that sold it, but it was the record companies that were very much in charge of the process."

Lewis Jamieson, Director of Communications and Industry Relations for Music Declares Emergency

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19   See for example: **https://www.shambalafestival.org/essential-info/sustainability/impact-report-2022/**, **https://ajc-jazz.eu/etude-carbone/**
20   Lostanlen, V. (2023) op. cit., p.3

Metaverse, NFTs, Artificial Intelligence, Blockchain*: this new digital arms race, the effects of which no-one is measuring

New technologies have flourished in recent years, such as the metaverse, Artificial Intelligence (AI) and NFTs. A range of new digital services are offered to artists, like the *Pianity* or *Opensea* platforms which offer NFT marketing and auction marketplaces[21]. Others are aimed at the entire population, like Chat GPT and Midjourney which offer, respectively, the generation of text and images using artificial intelligence.

It seems that electronic music artists are the most easily attracted by the opportunities for experimentation offered by these new possibilities, such as Jean-Michel Jarre, who even got involved via a platform defending the idea of a European metaverse. This interest is not, however, the sole prerogative of electronic artists:

"Empirically, I see more so-called electronic musicians taking advantage of new online technologies for aiding creativity and remuneration […] We have also seen certain rappers adopting them enthusiastically, with an appetite for using computers to assist their creativity, using artificial intelligence. In jazz too. […] If we look at the pioneers who work on new emerging technologies, ten years ago, they were jazz artists. As an example, we can mention Bernard Lubat, who worked with Marc Chemillé from IRCAM on Djazz[22] then IMPROTECH[23]."

Maxime Thibault, Head of Innovation and Ecological Transition Expertise at the Centre National de La Musique (CNM)

When it comes to NFTs, artists' appetite for this technology is not confined to any musical style, as the following, numerous examples of projects demonstrate. However, it's notable that the artists who have used this technology in their work are distinguished by their multidisciplinary approach. Riles[24], a prolific French rapper, launched his *Sunday Stones*: for an entire year he set himself the challenge of publishing an original track every Sunday accompanied by a visual of a stone that expressed "the mood of the song". Electronic artist Agoria[25] markets NFTs consisting of digital art set to music. In the latter case, it should be noted that the sales of his NFTs would have allowed him to generate more income than during his entire musical career, whether through live shows and on more conventional music formats.

21 Digital application or service creating a marketplace enabling third parties to trade goods and services.
22 **https://digitaljazz.fr/**
23 **http://ehess.modelisationsavoirs.fr/improtech/**
24 **https://foundation.app/@riles**
25 **https://agoria.dev/nfts**

"There is a niche of avant-garde artists that either implement their own artificial intelligence to expand their creative powers or that use blockchain to distribute or find very innovative and out-of- the-box ways of circulating their music and having the fans involved. [...] But I think it's a very small group of people compared to most of the people we work with in the music industry"

Anna Zo, Operations Manager at Music Innovation Hub
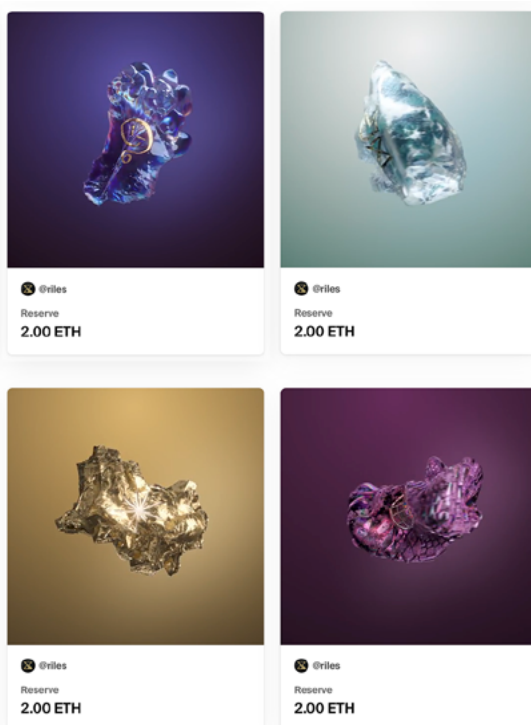
Rilès's Sunday Stones (NFT)

In addition to purely musical and visual works, NFT technology can also be used to support fan relations. Black Dave[26], a multidisciplinary American artist whose work combines jazz with manga, offers his fans the opportunity to finance his career by purchasing his collectibles, the first of which, unveiled in 2020, was an unused artwork

project for a cover. Snoop Dogg sells an NFT pass which provides access to exclusive and evolving content. At the end of 2021, Booba[27], a French rapper based in the United States, declared that he had sold the 25,000 NFTs that he had put up for sale, giving exclusive access to his new music video, and from which he was going to draw a winner who would have premium access to his future concert at the Stade de France.

Finally, NFT ticketing has developed[28] in the context of sporting and musical events, generally allowing access to advantages such as access to pre-sales, choice of seats and other exclusive content before or after the show.

The professionals interviewed have a mixed view of the capacity of these new technologies to imprint themselves on artists' processes. Many of them insist on the deceptive nature of some of these innovations, like the blockchain*, on which NFT technology is nevertheless built in the same way as cryptocurrencies.

« There's definitely a lot of scepticism when it comes to these new technologies. They have not always proven to be as useful as artists have been promised in the past. Live streaming concerts is one of those things: everyone was supposed to be streaming during Covid and it ended up only being really useful for a handful of artists. Same in a way, I would say, with NFTs, they are kind of already proving to be kind of a false promise when it was supposed to be this great new income source for artists."

Anna Dungal, Events team for Iceland Airwaves & Sena Live, founder of OK Agency

26   https://nftnow.com/music/black-dave-rapper-producer-making-waves-in-nfts/
27   https://www.radiofrance.fr/mouv/booba-reussit-son-pari-ses-25-000-nft-ont-ete-vendus-7086467
28   https://cryptoweek.fr/les-billets-nft-entrent-en-scene-en-2022-connectant-artistes-et-fans

It is also revealing to note that this observation, arising from these interviews, says a lot about the level of technological maturity in the music sector. Our questionnaire contained an open-ended question regarding new technologies. While we didn't specify any specific technology, a majority of respondents mentioned social networks. Anna Dungal's remarks concerning artists seem to us to apply entirely to professionals as a group.

"They are not always at the forefront of these things. I still know artists that are struggling to accept Tik Tok, when it's something that's become almost a prerequisite […] I think it much more likely that the majority of artists will remain sceptical."

Anna Dungal, Events team for Iceland Airwaves & Sena Live, founder of OK Agency

Even the enthusiasm of ticketing and entertainment professionals seems more than measured in the case of NFTs which, after the tremendous boom of 2021 and 2022, are struggling to counter the severe decline in interest from the market[29].

"Potentially, it's generational. Very few artists have started to get into it, but I think it will move forward. […]. The basis of all this is the proposition. If there is an interesting proposition anywhere in new technologies, it will allow people to be interested in it."

Louis Favre, Associate Director of TradeSpotting

In 2023, it is artificial intelligence (AI) which is shaking everything up, particularly artists and professional organisations, due to the immensity of the legal questions it raises and the accelerating risks of misappropriation or counterfeiting. The attention-grabbing release of a fake collaboration between Drake and The Weeknd, generated using AI by an anonymous person presenting themselves under the name of *Ghostwriter*, illustrates this well. In the absence of a legal framework it was possible for this work generated by AI, using the

voices of living artists, to be posted on audio and video streaming platforms as well as on Tik Tok, and generate hundreds of millions of views before the various platforms concerned had any time to react. Still available, including on Spotify, it was even submitted to the Grammy Awards selection committee, forcing its director to draw up an eligibility policy regarding works originating from or having made use of AI. The metaverse was not a popular topic in our interviews and for the moment seems reserved for artists with a massive international audience, capable of attracting the interest of video game publishers, or widely established brands and start-ups. The artists who have "performed" there, most of them American, were the likes of Marshmello and Travis Scott, as well as BTS, Justin Bieber, Eminem and Ariana Grande.

The Ghostwriter who created a song using AI featuring the voice of Drake, on his Tik Tok account

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29   https://www.numerama.com/tech/1395898-deux-ans-apres-lemballement-que-reste-t-il-des-nft.html

Are these new technologies expected to become a permanent feature of the way musicians work? This seems to be a likely outcome according to the majority of people consulted, a view which is confirmed by the historical and musicological perspective of Kyle Devine, who we also met as part of this research. It offers a historical perspective on the way in which musicians appropriate technical developments in instruments:

"Innovations in terms of musical instruments and musical technologies tend to create turbulence in the world of music. […] There's always a kind of dichotomy where some people really like it and chase it and pursue it in every way they can. And other people will say "this is ruining music". You know, […] "Drum machines are ruining music, synthesizers are ruining music. Digital audio workstations are ruining music, Auto-Tune is ruining music". And now the latest one is that artificial intelligence is ruining music. […] There's a controversy right now with Drake. […] I think it does raise really serious and interesting questions. But historically, the same kind of worry and excitement repeats itself over and over again. […] Auto-Tune, which […] was named one of Time magazine's 50 Worst Inventions Ever […] Is now another tool in the tool belt, in the music studio, in the live setting, in the jam spaces".

Kyle Devine, professor at the department of musicology, University of Oslo, Norway, advisory board member of Evolution

His explanation anticipates the future accumulation of these technologies alongside existing digital services and devices. This is precisely what is happening in live performance, where in the space of just 20 years the use of remote-controlled projectors has become widespread and, over the last ten years, ever more powerful laser video projectors, LED screens and other stage FX have all seen a surge in popularity. For the live shows of the biggest international headliners, it is even becoming quite common to see the use of live broadcasting. These entail real production teams who, in the

best-case scenario, make use of the video feeds of the teams already in place and, in the worst cases, move all their staff and video equipment using semi-trailers. This is the paradox of live music, which is engaging in a concerted effort to reduce its footprint, while at the same time using more and more technology on stage. Sociologist and musician François Ribac devotes part of his critique of the current management of the music sector's transition to the rebound and accumulation effects discussed here:

"In a system based on profit and expansion, the optimisation of a technology tends to be used by economic actors to increase their productive capacity and their margins. (…) Second, it is rare for one technology to be replaced by another. The rule is rather one of accumulation and coexistence, a point clearly illustrated in the work of Edgerton on the history of technologies and, more recently, in that of Fressoz on the "energy transition". In fact, oil has not replaced coal, which has not replaced wood, and renewable energies have not dethroned fossil fuels (…). Likewise, with the notable exception of the telegraph, no communication technology has really disappeared since the end of the 19th Century: television has not replaced radio, home video has not replaced cinema, emails have not replaced the telephone, the web has not eliminated earlier media – even audio cassettes have survived! All these technologies have become hybridised and we have witnessed a considerable increase and diversification of uses and… energy consumption.[30]*"*

The history of the evolution of technologies, in the broad terms employed here, leads us to think that all or part of these metaverses, AIs and NFTs, will establish themselves permanently in the landscape of the musical ecosystem, even though their impact is being neither measured nor controlled, and their architects refuse to communicate the data allowing their environmental impact to be assessed[31]. The material impact of these technologies, if not yet

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30   Ribac, F. (2023), pour une autre écologie musicale 1 et 2, Revue Audimat

31   **https://www.cbsnews.com/news/artificial-intelligence-carbon-footprint-climate-change/**

fully known, nevertheless borders on the predatory: a series of five to 50 searches on Chat GPT would consume on average half a litre of water[32], on a planet where 700 million people are affected by water shortage[33]. This profound paradox is found even in the public policies of certain institutions and governments, like the French government calling "at the same time" for the launch of "green alternatives" and "an enhanced experience of performing arts" as well as to the digitisation of the country's heritage.

We can observe a dangerous parallel between the storyline of the film *The Congress*[34], which in 2013 told the story of an actress whose entire appearance is scanned by the film studios so that can own it and make use of it forever, and the reality of Walt Disney Studios' practices. In fact, certain extras were apparently scanned during a Marvel shoot in August 2023, with neither the use that would be made of this scanning being explained to them, nor the fact that they should

have been paid for it[35]. With AI already threatening the dubbing and screenwriting professions, it would be a mistake to imagine that the music sector will be spared from this profound challenge to livelihoods which is coming. The recent and unprecedented Hollywood screenwriters' strike is a good example of what artists can achieve by mobilising collectively[36]. These technologies need to be challenged in the same way within the musical ecosystem.

"Is this the future?" Well no, not necessarily, if we can't solve this equation. These very energy-intensive tools are not at all putting us on a trajectory that tends towards digital sobriety. Is their use sustainable? Does it have to be available to just anyone?"

Maxime Thibault, Head of Innovation and Ecological Transition Expertise at the Centre National de la Musique.

32 https://www.geo.fr/environnement/eau-ia-generative-a-t-elle-fait-exploser-consommation-eau-geants-de-la-tech-openai-microsoft-google-chatgpt-216592

33 https://www.un.org/fr/waterforlifedecade/themes/scarcity.shtml

34 *The Congress*, (2013) by Ari Folman

35 https://movieweb.com/wandavision-background-actor-disney-scanned-replicas/

36 https://www.theguardian.com/culture/2023/oct/01/hollywood-writers-strike-artificial-intelligence

Streaming, or the age of "wasting material and effort"

When it comes to considering the digital environmental impact of the music ecosystem, streaming attracts most of the attention. As we mentioned previously, there is little, if any, data available, and the methods of calculation are not made public. The complexity of the infrastructure and the multiplicity of operators also contribute to making the analysis of the impact of these services impractical, and give rise to certain absurdities relating to the energy balance of the providers, as Vincent Lostanlen clearly describes[37].

In its *2022 Equity & Impact report*[38], Spotify claims that 98.9% of its carbon footprint falls within Scope 3, that is to say the part of its emissions produced by its suppliers, subcontractors, and by consumers of its services. Only a short paragraph, which is vague to say the least, addresses the essential question of the final use of Spotify's services (26.5% of its 2022 balance sheet), followed by a much more detailed presentation of the actions carried out on the company's premises, which represent only 5% of its balance sheet. Certain actions highlighted could be considered surprising: focusing on the reduction of its marketing impact, rather than envisioning a reduction in its digital campaigns or their eco-design, it highlights its approach of upcycling advertising tarpaulins to Lagos, which are transformed into bags for schoolchildren in the Nigerian capital. Finally, we note that the company gives equal importance to its policy of promoting content concerning climate change and its own impact reduction approach.

Audio streaming through streaming services, such as Spotify, is just one component of a wide range of music consumption methods. As indicated in the article 'Ecology, Music & Digital' published on Audiofanzine[39] in 2023, from which the graph below is taken, music is consumed in many ways on the internet. Whether it's by viewing videos, clips from live shows, or albums made available with still images, the increased bandwidth consumption is only made more significant by YouTube's default settings. These settings ensure the continued playback of files recommended by the algorithm based on the consumer's history, regardless of whether anyone is watching them, making video "this tap that flows continuously, without worrying about what it costs in energy and in the resources behind it…".

37   Lostanlen, V. (2023) op. cit., p.12 à 15
38   Equity & Impact report 2022, Op. Cit.
39   **https://fr.audiofanzine.com/le-pub-politique-et-societal/editorial/dossiers/l-impact-de-la-musique-numerique-sur-l-environnement.html**

Spotify and other audio DSPs are just one lane of an increasingly diverse music consumption landscape

Weekly active and users of selected music apps, 2017-2021, US, Canada, Australia, UK

Source: MIDiA Research consumer surveys 2017-2021, US, UK, Australia, Canada n = 4,000

graph taken from the article 'Ecology, Music & Digital, Greening Music in the Digital Age' published on 13th March 2023

Spotify participates in the DIMPACT[40] project led by consulting firm Carnstone, in partnership with the University of Bristol. This initiative works to "measure, understand and ultimately reduce emissions linked to the distribution of digital media and entertainment products". Its members include some of the largest digital service companies (Google, Netflix, The Walt Disney Company, WeTransfer and Spotify). During their gathering in June 2023 at the London Tech event, Becca Samson laid out the following conclusions for WeTransfer and on behalf of the other partners:

"The industry needs more transparency and standardisation. Using recognised tools and methodologies is important for credibility. Measurement and reduction must be prioritised before offsets. It needs to be a win-win: sustainability and performance."[41]

While we endorse the remarks highlighted in this summary, we are more sceptical when it comes to the theoretical foundations of the initiative. Indeed, their first publication, which was presented as a literature review (without including a bibliography), sets out principles guiding their actions which can be legitimately called into question: the document affirms, among other things, that digital industries are more advanced in their process of decarbonisation than those of aviation or international maritime transport, and therefore more capable of responding to the challenges of the ecological transition. This document also states that the increased dependence of human societies on digital technology would not have had the effect of increasing sectoral energy consumption, and that streaming would have a relatively limited impact compared to other leisure activities. Finally, the document recommends not defining a digital decarbonisation policy before having analysed specific data coming from stakeholders, which is recognised as being difficult to access, without being critical of this situation, or committing to leading by example and communicating their members' data transparently.

Far from pushing for structural changes to the services and systems offered by the digital cultural industries, the initiative essentially recommends a change in the supply of energy sources to renewable ones, and an increase in the performance of screens for individuals. She even suggests investing in global networks like 5G to avoid the use of specific networks such as home Wi-Fi networks, while other studies recommend just the opposite, highlighting that improving

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40   **https://dimpact.org/about**

41   **https://dimpact.org/downloadResourceFile?resource=5**

the performance of a network, from 4G to 5G, systematically results in an increase in usage.

"What's interesting in a way with the digital music part of this, so the DSPs, your Spotify, Apple, et cetera, et cetera, is how little data there is around them. There is as yet no authoritative piece of research that I'm aware of that documents the carbon emissions or indeed the environmental impacts of any or all of the DSPs. There isn't a single piece of research that I'm aware of that you could point to and say with clarity: this is the kind of impact of streaming. There are various pieces of research around that give you glimpse of it, but none of them have been audited in the way that the record companies have been audited, in the way the physical supply chains have been audited"

Lewis Jamieson, Director of Communications and Industry Relations for Music Declares Emergency.

At Deezer, Vincent Lostanlen found this same tendency to place "the responsibility of greening the enormous material infrastructure that connects them to the "service" entirely on the "subscriber"[42]. The company also indicates in its declaration of extra-financial performance that the activities of their group "have, by their nature, only a limited impact on the environment". No scientific reference has been identified that would enable us to confirm this. In his previously cited article, arguing against the ideology that emanates from DIMPACT publications, he highlights the waste that is produced by technology that was initially more virtuous than that which preceded it:

"It is to be feared that the age of streaming will be one of a waste of material and effort. Not that the format itself is more polluting, on the contrary: since it no longer needs a motor to turn the disk, the use of MP3 type files represents a gain in efficiency, all things being equal. But streaming, in its contemporary form, directs us towards more costly uses (downloading the same content repeatedly), towards frequent purchase of devices (to "take full advantage" of the service or simply because they are fragile and difficult to repair); and, consequently, towards an opaqueness regarding the ecological and social damage caused by the recorded music industry[43]."

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42   Lostanlen, V. (2023) op. cit., p.11
43   Lostanlen, V. (2023) op. cit., p.8
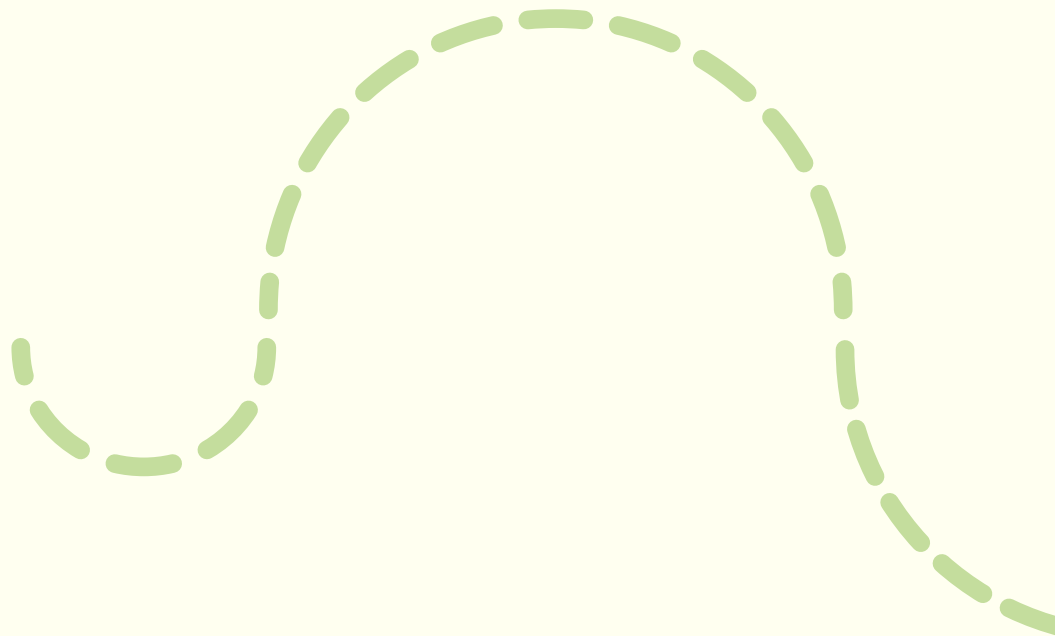
Essay 1:

The problem with calculating carbon emissions for digital music

by Matt Brennan (Professor of Popular Music, University of Glasgow)

One of the most frustrating problems for musicians trying to reduce their digital environmental impact is accurately calculating carbon emissions from streaming in the first place. This is a difficult challenge for at least two reasons.

First, we need to agree *who* should be responsible for the calculation of emissions (the artist, the manager, the label, the distributor, the platform, the internet service provider, the energy provider, etc.).

Second, we need to agree on how to robustly identify and measure all the intermediaries emitting carbon along the way from the moment the artist completes a record to the moment a consumer listens to it.

These two challenges are intertwined. Whether it's an individual or an organisation, we should all be reckoning with our carbon footprint. But does the carbon released from digital music *belong* to the individual artist? Their management company?

Their record label and/or distributor who puts the recordings onto digital media? The major streaming platforms who mediate access to recorded music catalogues? The internet service providers upon which the platforms depend? The manufacturers of the devices (phones, laptops, tablets, etc.) on which we listen to digital music? The energy companies who fuel these infrastructures? Or the consumers listening to the music on the other end?

Let's use the example of the emissions inventory report for Beggars Group, which in 2021 announced its ambition to transition to become a carbon negative business by the end of 2024. Beggars Group is one of the biggest independent record labels in the world: in fact, it's a consortium of five independent labels: 4AD, Matador, Rough Trade, XL, and Young. To give a sense of its scope, the annual revenue of Beggars Group is in the region of £80m and it has artists as big as Adele and Radiohead in its catalogue.

The international industry standard for calculating carbon emissions is called the Greenhouse Gas (GHG) Protocol, which classifies corporate carbon emissions into three 'scopes', and the Beggars Group report dutifully estimated its emissions using this industry standard. In its report, Beggars Group identified ways to reduce its Scopes 1 and 2 emissions (i.e. from fuel consumed and electricity used in the company's offices and studios), but also noted that 99% of its emissions are Scope 3, which includes purchased goods and services (like CDs and vinyl), upstream transportation and distribution of those goods and services, and downstream distribution such as emissions from streaming platforms like Spotify.

The company aims to reduce the emissions it controls and offset the rest of its emissions (including emissions from its recordings on streaming platforms), thereby becoming net zero. But you can see how this quickly becomes a slippery slope, with the responsibility for actually *reducing* emissions (as opposed to offsetting them) constantly moving from one stakeholder in the chain to the next.

I should be clear that I am using the example of Beggars Group not because I want to criticise them, but rather because their report is arguably the best and most thorough carbon accounting report that I have seen in the recording sector. Beggars Group are working harder than most record labels I know of to tackle climate change. And yet many of the most significant carbon emissions related to their business such as streaming digital music – *upon which their business model depends* – are assessed to be beyond their organisational control.

And this of course is not just a problem for the digital music industry, but for all industries in the global economy. How we solve this problem is beyond the scope of this essay, but the first step is to understand it, and I hope the analysis above serves as a small step towards this goal.

Matt Brennan is Professor of Popular Music and Convenor of the MSc Music Industries at the University of Glasgow. He has served as Chair of the UK and Ireland branch of the International Association for the Study of Popular Music (IASPM) and has authored and edited several books in the field of popular music studies. His latest book, Kick It: A Social History of the Drum Kit (Oxford University Press) was named one of the "best music books of 2020" by the Financial Times, and his previous monograph, When Genres Collide (Bloomsbury), was named as one of Pitchfork's "Favourite Music Books of 2017". In 2018 he led the UK Live Music Census, the first nationwide census of its kind in the world. He is currently researching environmental sustainability strategies for music cities, using Glasgow as a case study.

In the face of the challenges represented by digital, are we seeing an ecosystem that is depoliticised and "apathetic"?

To measure the level of interest of professionals in digital and ecological issues, we asked them all to estimate, on a scale of 0 to 5, how concerned they felt as individuals by:

- The climate crisis
- The ecological transition in the music sector
- The digital ecological transition of the music sector

In our sample we found that the level of overt interest in issues relating to the climate crisis was very high, averaging 4 out of 5. This level of proclaimed commitment, however, does not presuppose an application of these concerns to the musical ecosystem, even less so when it comes to the digital aspects of this musical ecological transition. Through their notes, professionals showed a decreasing interest when moving from thinking about the climate crisis in general to considering the vast majority of digital technology. Whatever their response to the climate crisis, their interest in the digital side of these environmental transformations in the music sector has been significantly lower.

"I've not heard about it when it comes to the digital aspect. The artists that I'm in conversation with think more of the physical, you know. The carbon footprint of their touring, the carbon footprint of their manufacturing when it comes to vinyl or merch."

Anna Dungal, Events team for Iceland Airwaves & Sena Live, founder of OK Agency

As you might expect, the only exceptions to this observation are members of companies offering digital services and those working on these issues in the music ecosystem or as part of their research. However, these professionals declare a level of interest in the musical ecological transition that is between 3 and 4 on a scale of 1 to 5.

Digital and ecological questions are something that most of the professionals we met have never thought about. Recurrently, when we asked them about their level of interest and personal commitment, they declared that they did not work enough on these issues in a professional context, or did not do enough about it.

"Many people around me were convinced of the need to transition and had taken an individual approach, to the point of becoming completely vegan for some of them, but (they) were unable to implement these values in their work. I have been trying to find a term to talk about this problem which seems to be a form of professional apathy. [...] That of not bringing the ecological dimension, the planet, biodiversity into their work."

Fabrice Jallet, Head of Entrepreneurship and Incubation at Bliiida.

When it comes to digital issues, the lack of knowledge and understanding, as well as interest, is obvious, and a sign of the immaturity of the sector in this area. This lack of interest is not without cause: it can be explained by the few existing professional projects to date that are capable of mobilising people around these questions. We have observed this in the field of live performance: if the questions concerning the ecological transition of live performance have spread widely in the ecosystem, it is thanks to initiatives engaged in by events, collectives and the myriad service providers who have been mobilising for 20 years. It is this dynamism, coming from the sector and not from professional organisations, which makes it possible in 2023 to collectively question the very foundations of current procedures: exclusivity clauses, tour plans based on intensive use of planes, the quantity of technical equipment that accompanies artists on tour, the energy consumed by events, the mobility of audiences… This dynamism simply does not exist on the digital side of the musical ecosystem and surely explains in part why our interviewees couldn't identify any solutions.

This lack of knowledge and mobilisation can also be explained by the perceived (rather than real) immateriality of digital activities, which constantly comes up as an explanation for this low level of interest. Here we find the rhetorical trap which tends to confuse digitalisation with dematerialisation, as pointed out by Kyle Devine in his study *Decomposed* and taken up by Vincent Lostanlen in his analysis of digital ecology.

"One of the things we do is we offset carbon. […] Surprisingly a huge part of it is software. Which I thought was surprising because, you know, software is digital, right? It's not like where you imagine a T-shirt that gets made. […] The factories have got to run, you've got to ship it. And all that stuff feels like you can just feel it. Whereas digital, it's kind of a bit abstract."

Jonny White, CEO of Ticket Tailor

In this context, new initiatives are rare, and some have become exhausted in the face of the inertia of the system, as highlighted here by Fabrice Jallet in 2019:

"I had met someone at a MaMA (a professional music conference in Paris) who was trying to create a recovery circuit for optical discs […] I tried to help him for a while, I contacted the SNEP, the civil societies of phonographic producers, SCPP, SPPF, the network of record stores. And both of us were worn down by people who said "Yes, we must act, we must act".

Fabrice Jallet, Head of Entrepreneurship and Incubation at Bliiida.

Polish pianist Wojtek produced an album in 2020 that he presented as "carbon neutral", presenting the approach on the home page of his website:

"I recorded and produced it carbon neutrally. […] I recorded Atmosphere in a studio that uses renewable energy. I ensured that the same amount of renewable energy was provided to the energy grid as was used during the recording and the production. […] I was supported by a climate and energy expert to map the potential emissions to be able to eliminate them and compensate in the most credible way. […] even a debut artist can make a difference."

Screenshot from Wojtek's website

Although we might question the truly carbon neutral nature of the recording of this album, as the approach seems to focus primarily on the issue of energy, we can salute the originality and merit of the initiative. On other issues more related to digital models, American band Lorenzo's Music work only with royalty-free systems and software, in a collaborative and open spirit that is far removed from the rationale of the SAAS model. This "creative commons band", as it likes to present itself, justified its choice in an interview given to Forbes[44] on the subject:

"Anyone can use our music for videos, movies, apps and re-sample and build upon it for whatever they wanted as long as they gave us credit or attribution. So we believe in the concept of open source culture. It just made sense to create with things that have the same principles. The thought was this: musicians spend a lot of time and money on gear and instruments already and we wanted to know what could be done with open-source tools as an option. It's just really cool to know that there is a community of people out there making software for musicians and artists that fall under the same ideology of sharing and availability for everyone. And it's possible to do it!"

Only a few labels have made their approaches to calculating and reducing their carbon and environmental footprint public. The most significant and instructive are those of Ninja Tune[45], which in 2008 stopped using the characteristic and polluting transparent plastic jewel cases, and which has since changed its method of heating its offices, halted the acquisition of company vehicles and even uses sea freight rather than air freight wherever possible. The Beggars Group's work calculating its carbon impact[46] is an example to follow in terms of transparency regarding the origin of its data, its methodology and the reasons given for excluding some factors from their calculations.

Unsurprisingly, it is again scope 3, that is to say the one including the impact of suppliers and beneficiaries of the work of music labels, which is the most important item. Some of the digital services companies we interviewed are also trying to reduce their impact on the aspects that they control and where they have room for manoeuvre. However, they tend to focus on the responsibilities of DSPs* while bemoaning their dependence on them:

"We did what was necessary to have servers in France that do not pollute, […], the agency has had its 'Responsible Digital' certification. We are in the process of carrying out an audit, at the first level, to see what we can do. We no longer buy new computers, only refurbished ones. We're clearly not as good as we can be, we know that, but we need to move forward, and that's why we contacted the providers of the 'Responsible Digital' certification, the LUCIE agency, which allows us to see more clearly. But as long as META remains ultra powerful and I need it to promote the projects I'm responsible for, I can't do without it. For what we are able to control, though, we do have an approach."

Louis Favre, Associate Director of TradeSpotting.

This dependence was also expressed numerous times with regard to artists:

"Artists have a really hard time making a career for themselves if they choose not to engage with Meta or with Spotify"

Anna Dungal, Events team for Iceland Airwaves & Sena Live, founder of OK Agency

It seems particularly difficult for software publishers to consider breaking away from current hosting mechanisms, such as those in place at Amazon Web Services (AWS), which has a 32 to 35% market share of storage infrastructures online.

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44   **https://www.forbes.com/sites/jasonevangelho/2018/09/25/open-source-challenge-why-one-band-chose-linux-to-record-their-new-album/?sh=21b27c0c4439**

45   **https://ninjatune.net/sustainability**

46   Beggars Group carbon emissions inventory report: **https://beggars.com/group/sustainability**

> **"The way it used to work is you'd have your website on a server and that would be it. It'd be nice and simple. Now with these web services, they're broken up into small pieces. And so we use probably 20 different products on AWS to provide our service. Even if there was a comparable service that could do all that stuff, getting out of this ecosystem would be really hard"**
>
> **Jonny White, CEO of Ticket Tailor**

Another initiative similar to that of the previously mentioned DIMPACT is now emerging from *Greening of Streaming*, an organisation bringing together many players in digital broadcasting (cloud hosting or cloud computing services, video/audio broadcasting, consulting firms, various digital services) to implement measures and establish good sectoral practices with a view to reducing the impact of their activities. Their latest project entitled LESS Accord[47] aims to bring together the research from different members, with a view to reducing the energy consumption of video streaming and bringing together technical stakeholders in this industry.
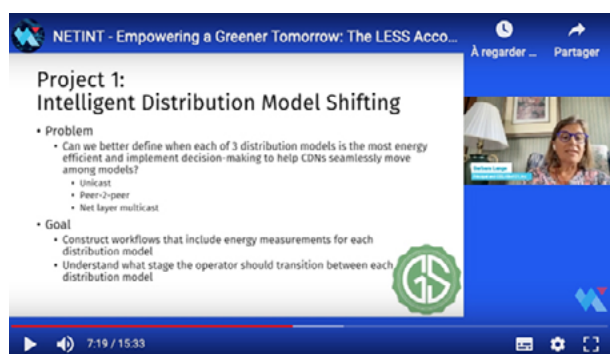
Screenshot from the video presentation for the LESS Accord project from Greening of Streaming

Two of the main European organisations in recorded music have been working since 2021 to establish measures to decarbonise the activities of their members. Impala, which represents around 6,000 independent labels across continental Europe, has been engaged since 2021 in a climate transition trajectory that it has formalised through a climate charter[48] and several actions and tools, including the creation a carbon calculation tool for record labels. More recently the organisation has expanded its work on carbon footprint reduction through the IMPACTS project.
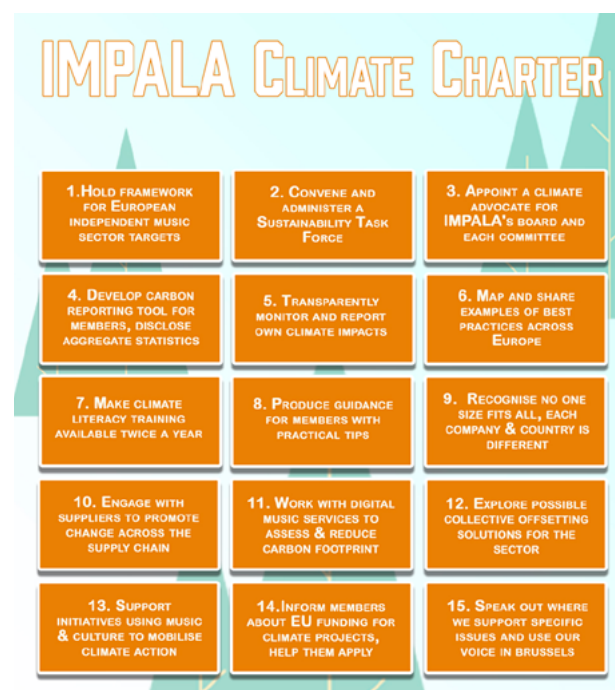
The Impala network's climate charter

In parallel with Impala's work, the British independent music association, AIM, has also set up an initiative through the Music Climate Pact[49]. This pact commits its signatories, including Beggars, Ninja Tune, Universal Music Group and Sony Music, to embarking on a carbon reduction process, to participate in sectoral initiatives to develop new approaches, and to support artists speaking publicly about these issues.

47   https://www.greeningofstreaming.org/post/the-less-accord-a-quick-introduction
48   https://www.greeningofstreaming.org/post/the-less-accord-a-quick-introduction
49   https://www.musicclimatepact.com/

The Pact's founder signatories have committed to:

· Take individual and collective action to measure and reduce our greenhouse gas emissions (scopes 1, 2 and 3)

· By February 2022, have either signed the **Science Based Targets** standard commitment letter stating that we will commit to setting science-based targets or will have joined the **Race to Zero programme**

· Work together as an industry to establish carbon measurement methodologies, tools and frameworks backed by climate science

· Work in partnership with shared suppliers and digital streaming platforms (DSPs) to obtain data and drive emission reduction projects in a collaborative fashion

· Support artists in speaking up on climate issues

· Communicate openly with fans about the impacts of the music industry.

Excerpt from the Climate Music Pact

Lastly, we can also point to REC project carried out in France by the main French professional institutions and organisations in the field of recorded music. Launched in 2023, this study aims to define "a multi-year low-carbon strategic roadmap" for recorded music by spring 2024.

These initiatives, which are still very recent compared to those in the live sector, and which for the most part are still getting going, have not yet spread across the entire recorded music industry. They are not advanced enough to offer technical solutions and models for reduction, but together they constitute a serious, legitimate platform from which to initiate this trajectory.

The music sector and digital responsibility

The imbalance is clear between the level of engineering and creativity that we observe in the live sector as it works on its transformation, and the degree of reflection relating to digital, where nothing, or very little, is happening at all at the present time. Listening to professionals, it appears to us that the lack of available data, and the resulting lack of knowledge and of solutions that do not emerge as a result, create a vicious circle that those in the profession need to break in order to initiate this transformation.

Professionals unanimously express a need for training about and awareness of the socio-ecological issues relating to digital music. From this perspective, the creation of knowledge based on data that is both genuine and thorough is an urgent and compelling precondition.

"Today we are releasing a song from a band we created in our club called Music Box. Of course, it's mainly an online strategy. If I was doing it with flyers on the street, I could feel the impact of paper. But we are doing it through Instagram and don't have the idea of what that means in terms of impact. But I know that it does. And I know it's big. And I've seen studies of these huge computer centres. But you don't feel it when you're doing it."

Gonzalo Riscado, Cultural Manager, CEO of Music Box & CTL

The perceived lack of alternatives, whether real or not, increases artists' feelings of lack of choice:

"The artists I work with all have an interest in eco-responsible issues but use standard tools. If they had the choice of more eco-responsible alternatives, I think they would use them, but there is a lack of information and alternative proposals."

Céline Garcia, artist manager, co-founder and General Director of Puppet Master.

Three documents for further reading:

Environmental Sustainability in the Digital Age of Culture, Julie's Bicycle (2020)

British organisation Julie's Bicycle, whose work is globally recognised in the field of cultural ecological transition, has published a document summarising the challenges faced by the digital industry in general, applied to the cultural and creative industries sector. Particularly informative, it provides, in just a few moments of reading, a familiarity with the notions of circular economy, the Cloud, life cycle analysis (LCA*) and data centres. It also offers five recommendations for reducing the impact of one's digital services and usage.

https://juliesbicycle.com/resource/briefing-report-environmental-sustainability-in-the-digital-age-of-culture/

Cultural actors, avenues for a more responsible digital technology by the French collective Œuvres Vives (in French)

This very comprehensive document, which is both inspiring, technical and very affordable, is a valuable resource for those wishing to train in responsible digital communication, and covers, in a cultural context, questions as broad as the design of a website, creating and distributing videos, and creating podcasts and newsletters.

The document can be downloaded here:
http://www.tmnlab.com/wp-content/uploads/2023/01/LB-Num-Res-05-12-22_5.pdf

The Cost of Music, a short film by Matt Brennan & Graeme O'Hara

In just ten minutes, this film explores the history of the materiality of music and its environmental footprint, and offers an approach to the question of music distribution media that is both sensitive and scientific.

https://vimeo.com/330024432

The commitment of artists

What role should artists play in this transformation? To take ownership of the digital issue, music professionals need to be aware of and understand the physical impact of their activities. Artists in particular need to be accompanied, assisted, and supported when they embark on this path. Because if the pressure to be exemplary affects all people expressing themselves on social issues, it hits artists even harder and creates an effect of self-censorship:

"Artists are very wary of speaking out too much about sustainability, as you probably know, because they get a lot of negative feedback. When, for instance, Bonobo signed the Music Declares Emergency declaration and talked about the importance of sustainability, the next day The Daily Mail newspaper published an article listing his tour dates coming up and the amount of travel. Just a sort of terribly negative article. So, he doesn't like to say anything, and he doesn't feel like he has much power. I mean, he has power in that he can talk to his management, his tour management about how he manages his tours, how he routes his tour, etcetera. But I think a lot of artists don't really feel like they do have much power because they don't feel they can say much publicly."

Peter Quicke, **former co-CEO now Chair of Ninja Tune, co-founder of Music Declares Emergency, co-founder of Climate Action Group, member of Impala's Sustainability Committee**

According to Ragnar Berthling, to be able to change, we must understand, and include artists in a positive approach to the environmental problem:

"It's not about giving artists a bad conscience that they don't do enough. I think you'd have to be much more proactive and take a positive approach to the subject in general, (one that says) that we are part of something bigger where we actually have the possibilities to create a sustainable future together."

Ragnar Berthling, Managing Director of Musikcentrum Öst & co founder of Keychange

All those interviewed agree on the idea that artists could inspire and embody change in the music industry in the eyes of the public and for the entire ecosystem. However, is this their role?

"I get tired of an artist who is signalling all types of messages all the time because the society feels that they should. So we can't make them our communication platform, however good the messages are. I think if the artists pick up on it and many do because they personally care, that's great. But we can't. I would be very careful in putting a social expectation on them as a group. But in general, as people, we, we have this responsibility"

Virgo Sillamaa, Music researcher at EMEE

One idea emerging quite clearly from the interviews relates to the same consumer/industry tension that exists in the public debate on climate change. It can be summarised as follows: it is not legitimate to place the responsibilities that weigh on the music industry on the shoulders of artists. This pressure would commit artists, who are already living precariously thanks to the current methods of remuneration for online music, to put themselves at even greater risk, both vis-à-vis an industry that has still barely mobilised around this issue, and with regards to a public quick to demand perfect, exemplary behavior from public figures who speak out. It is therefore a matter of ensuring that the industry plots its own trajectory with the help of artists, and not the other way around.

"Most of the artists follow the dynamic of the business itself. So if you have to use a digital distributor and the DSPs to deliver your music, you're going to use that. […] of course there should be greater awareness and education for the artists to actively have a say and change the system. But that also has to be in the system itself."

Anna Zo, Operations Manager at Music Innovation Hub

All those interviewed tended to agree on the idea that artists can, on the whole, contribute to the media coverage of these issues, particularly with regard to the behaviour of users of audio and video streaming. But while a majority of respondents believe that world-famous artists have influence over the industry and an ability to drive this type of message, the managers we met have a more cautious position.

"Artists have a lot of power but they quickly come up against walls, like the music industry. Artists can say no to certain things, but do not always have the power to prevent them. […] It must come from the behavior of agents, publishers too, but also labels, and the majors have a key responsibility in this regard."

Céline Garcia, artist manager, co-founder and General Director of Puppet Master

It is in no way guaranteed that these artists, who are part of society along with every other citizen, will be willing to make and embody these changes.

"I think that there's a very superficial level of agreement. But it's not only artists. […] if you ask the general population if they're willing to make sacrifices or difficult life choices, I think the answer is no. I don't want to sound cynical, but I think the individual responses are very weak. They are within the comfort zone of an individual and their mental capabilities. And artists are not ecologists. So they often fall for something like an eco-startup that offers them I don't know what. (…)I don't think that, on an individual level, they can have a large impact. But I think that they care."

Daniel Antal, Data Scientist & Co-Founder of Reprex

If we want to change the practices of artists, those of their ecosystem must change, and their professional entourage must communicate and support them.

"The main focus of any campaign like this or any idea to make a change should always be to pressure the big powers in the industry rather than trying to convince the artists".

Anna Dungal, Events Team for Iceland Airwaves & Sena Live & founder of OK Agency

I think it's everyone's role to take some responsibility for what they do and the footprints for it. Obviously, at the same time, it's not 100% their responsibility. The main responsibility lies with the people who supply this technology. [...] It's not their responsibility to reduce the footprint of how these applications work, but that ought to lie with the creators of the applications and the ISPs. [...] It's not for the artists to improve the business practice of the digital music sector. It's for the digital music sector to do it."

Lewis Jamieson, Director of Communications and Industry Relations for Music Declares Emergency

Essay 2

The possibility of alternative models

by Camille Pène

After going through the "record industry crisis" linked to the development of digital media and the distribution of music in the form of files at the beginning of the 2000s, the music industry was able to build, before all other cultural industries, an alliance with technology. Initially perceived as a threat to creation and copyright, digital technology has become a promise of innovation, creativity and new market shares for the sector. In 2022, global recorded music revenues grew by 9%, reaching a massive $26.2 billion. Music streaming now accounts for 67% of total global recorded music revenues, or $17.5 billion.

These figures from the 2023 IFPI Global Music Report demonstrate the vitality of an industry whose revenue model is largely based on streaming. However, it has weaknesses. The Covid-19 pandemic has strongly exposed those in the live sector while, conversely, digital uses have emerged strengthened. Today, given their environmental impacts, it is the ecological risk that calls into question distribution strategies based on technology.

Music professionals find themselves disoriented by the contradictory imperatives of growth and sobriety, innovation and ecological responsibility. How can the sector implement a digital sobriety strategy that respects reduction objectives for GHG* emissions without cutting corners on creation, experimentation and reaching audiences? What solutions should we adopt to reduce the negative side-effects of digital technology? What uses of digital technology should we give up?

Digital, a zombie technology?

According to figures recently published by ARCEP (France's regulatory authority for electronic communications, postal and print media distribution), digital technology today represents 4% of GHG emissions. If we do nothing, the carbon impact of digital technology could increase by 45% by 2030. Think tank The Shift Project points out that online video represents more than half of global data flows and more than 300 million tonnes of CO2 per year, with the majority of these videos being classified as "hits", i.e. music videos. These figures, which do not take into account the share of live music on social networks, illustrate the music sector's major responsibility when it comes to reducing GHG emissions linked to digital technology.

ADEME (France's environment and energy management agency) recently revised its assessment of the environmental impact of a smartphone upwards, based on figures provided by manufacturers, who have proved to be surprisingly transparent. The figure of 85 kg of CO_2 takes into account the emissions linked to the manufacture of the smartphone, but also to its recycling, its transportation and its use. It includes the electricity consumption of the smartphone over three or four years but not the carbon footprint of the telecommunications networks which connect them to the internet, nor of the computer servers of *YouTube*, *TikTok*, *Instagram* and platforms through which the music industry is able to distribute its products.

One of the major environmental issues for digital technology, in addition to its carbon footprint, is the availability of vital metals and other resources used during the final manufacturing phase. Relevant environmental indicators include:

- water: air conditioning and 24/7 cooling of data centres* consume 50% of their energy. We know less about their water consumption, amounting to 84 million litres for a Microsoft data center in the Netherlands in the summer of 2022, during a water shortage.

- sand: it is the second most exploited resource after water, used as one of the essential components in the manufacture of microprocessors. Without it, there would be no computers, cell phones, bank cards, etc. Sand consumption has tripled over the past two decades. Its scarcity now leads to the exploitation of oceans and coastlines.

- rare metals: 40 different types are needed for a mobile phone, the manufacture of which requires the extraction of 60 kg of raw materials.

The report "Assessment of the Environmental Impact of the Digitalisation of Cultural Services" (ADEME, November 2022) analyses several different modes of cultural use through a Life Cycle Analysis methodology, and systematically compares "physical"

and "dematerialised" uses, like "listening to music" on a CD and via a streaming platform.

The conclusions highlight the fact that recent 'digital' cultural services are just as physical as historical 'physical' cultural services: these services need user equipment, network infrastructure and data centers to be able to function. The 'hidden' materiality is therefore just as important: there has been no 'dematerialisation' of impacts but only a digitalisation of certain uses which were 'physical', in the sense that a physical medium made it possible to store and read the content. For all the scenarios analysed, the manufacturing of equipment represents the largest share of the impact across the majority of environmental indicators.

The streaming of music requires terminals and infrastructure, and its impact can be greater than that of listening to a CD, as long as equipment such as speakers or Hi-Fi equipment are used. Streaming music can even lead to being over-equipped - with headphones, speakers, etc., and therefore to more intensive use of that equipment.

It is also necessary to underline the ripple effect between data volumes and the sophistication of terminals. This is what we call the rebound effect*: while a new technology allows for gains in energy performance, it naturally leads to new uses. At the heart of the controversy over 5G in France, experts warned of a risk that has become reality: the quality of the network and the speed of connections lead to a rise in data consumption, in particular through the increase in viewing of videos on mobile devices.

A digital sobriety strategy is necessary to reduce GHG emissions linked to the manufacturing of equipment and uses of the technology. In the music sector, as for all businesses, it will soon be imposed by national low-carbon strategies which respond to the direction of European policy.

In addition to the ecological disaster it represents, digital technology poses a problem of sustainability,

in terms of its ability to withstand the passage of time. Digital technology is a "zombie technology" to use the terminology of researcher José Halloy, who employs the term to describe the unsustainability of technical systems that are doomed to disappear, particularly because of the exhaustion of the natural resources necessary for their manufacture. Electronic system manufacturers have recently faced the depletion of silicon following episodes of severe drought in Taiwan. This is the first publicised crisis in a long series to come.

Innovation in music and planetary boundaries

In spite of this, the music industry perseveres in a race for technological innovation that ignores planetary boundaries. This development strategy needs to be questioned both from an ecological and an economic point of view.

The metaverse

The metaverse is the subject of numerous private and public investments in the music sector. Led by musician Jean-Michel Jarre, the committee of the CNC (the national centre for cinema in France), dedicated to the promotion of immersive creative formats and the metaverse, is granted a budget of 3.6 million euros by the French state. Following Travis Scott's concerts on Fortnite or Alonzo on GTA, many start-ups are betting on the potential of virtual concerts, like *Ristband* or *Vroom* to name but a few.

However, while the metaverse is a virtual world, it is accompanied by a very material reality. It could rely on the UHD video streaming technique in VR which, according to a Cisco forecast, would increase bandwidth requirements on networks by 30 compared to current cloud gaming techniques. To meet this growing need for bandwidth, it is necessary to adapt network infrastructures - implementing 6G for example.

In addition to the energy consumption of networks, the development of the metaverse is accompanied by new hardware and peripherals such as VR headsets, which are doomed to cultural and technical obsolescence by technical progress. This is an opportunity to remember that 82.6% of digital waste was neither collected nor recycled in 2019.

NFTs

NFTs ("Non Fungible Tokens") are also a focus for some music industry investments. On the label side, NFTs are the subject of numerous experiments with the aim of identifying more reliable and engaged audiences, "super fans" in a way. It's also a great way to communicate with the most active listeners and reward those who get involved in the careers of their favorite artists.

For artists, the authentication of these digital objects by blockchain* holds the promise of being able to regain control over their content and interact directly with their communities and engage them more strongly by establishing decentralised relationships and removing intermediaries.

However, a very powerful mechanical system is necessary in order to produce NFTs, capable of carrying out very complex calculations. These "mining processors" consume around 91 terawatt hours of electricity per year, approximately the consumption of Finland.

Generative AI

AI is now capable of generating content on its own, based on a "prompt", a command in natural language. These tools, like Chat GPT, Midjourney and Music LM to name just a few, are very easy to access and

generate images, videos, slides and audio very smoothly and quickly.

Different fields, that were previously reserved for graphic designers, designers or artists, are now accessible to a large number of people without technical skills. But the consequence is the same as that produced by no code platforms which allow you to create software without coding a single line. Making a technology more accessible, by reducing its technical complexity, by reducing its production time, or by increasing the efficiency with which a resource is used, promotes its propagation. This is the rebound effect of innovation: technological improvement leads to increased consumption of resources.

It is also important to highlight the hidden environmental cost of the calculations required by generative AI. There are no figures on the number of Midjourney or Dall-E requests today (if focusing only on visual generative AI). META, Facebook's parent company, recently unveiled AudioCraft, a music-focused generative artificial intelligence. This tool aims to offer the general public the possibility of easily creating audio elements to enrich various projects. It can be added to the list of other applications that are already available, such as SongR or MusicGen. This has implications first and foremost for the music sector and music creators.

The absence of digital sobriety policies

While dreaming of technology, the music sector is becoming aware of both its responsibility and its vulnerability in the face of the ecological crisis. Extreme weather phenomena, such as violent storms and heatwaves, the consequences of climate change, are causing the cancellation of a significant number of concerts and festivals. It's an old reality but one that the public became more aware of in the summer of 2022. In the wake of collectives like Music Declares Emergency, which have been warning of these issues for years, event organisers and venue managers are already implementing commitments to reduce waste, introduce plant-based food, reduce energy consumption and decarbonise mobility. In France, the Aeronef concert hall in Lille and the Transmusicales festival in Rennes are among the most determined, without however tackling the question of digital technology's environmental footprint.

Record labels, to whom these questions also apply, refrain from making comments about the impact of digital technology. Video and streaming companies implement mitigation measures without thinking about adapting their model. TikTok presents the Let's Go Green with TikTok campaign on its site and displays the percentage of videos that deal with environmental

issues, without presenting any internal policies to reduce its emissions. YouTube, a subsidiary of Google, announces that "each YouTube video viewed does not cause any emissions from (its) Google data centers". But if YouTube has a "net zero" rating this is thanks to its carbon offsetting policy, with the company purchasing carbon credits to offset its electricity consumption. It has issued 5.75 billion green bonds on the markets to finance projects contributing to the ecological transition and is one of the largest buyers of renewable energy in the world. The green bond is a loan issued on the financial markets by an "issuer" (company, community or state). It differs from a traditional bond in that it exclusively finances projects favorable to the environment (for industries or ecosystems). Google's compensation policy hides the absence of published data on real energy consumption and its GHG emissions. The Spotify site is silent on the subject of ecology. Deezer is working on the energy efficiency of its servers and the reduction of available audio content. But subscription offers continue to feature unlimited access to millions of tracks. This advertising argument runs counter to the constraints imposed on us by planetary boundaries.

On the artist side there are differing opinions. In his article published on the politically engaged French site Bon Pote, Samuel Valensi, coordinator of the 'Decarbonizing Culture' report from think tank The Shift Project, raises the question "Can we dismiss the carbon footprint of the artist?" and highlights the carbon-rich images conveyed by the stars, through mega concerts and flights in private jets. Some, like those involved in the collective The Freaks, are committed to reducing their carbon emissions, but none broach the subject of the impact of digital technology.

The sector's digital beliefs

If the environmental impacts of digital technology remain largely ignored and investments continue, this is, in our opinion, a result of deeply held beliefs about this technology.

Replacing all the middle men, professionals and expertise, digital technology would allow artists to make themselves known on their own, to take responsibility for their distribution, to reach all audiences, including young people, to renew and enhance the musical experience…

Technological innovations arrive one after another and start to pile up but the promises remain the same, from the launch of the iPhone to the recent craze sparked by the metaverse.

For fans, the belief is that of accessing, through platforms or even NFTs, a more direct, more intimate relationship with the artist they admire. For the labels, the challenge remains above all to increase their market share. Despite the advertised disruption, the models have remained the same. The myth of the long tail has fizzled out and labels remain in a position of domination over artists.

The latest digital promise is that of decarbonisation. Digital technology would be an ecological solution that would avoid the need to travel thanks to the broadcasting of concerts, or which would dematerialise communication formerly based on paper media. However, in this situation as in any other, digital use does not replace previous use. It adds to it, thus increasing carbon emissions. It is not because concerts are broadcast on video that artists and fans no longer travel. It is not because communication takes place via platforms that carbon footprints decrease. Here again, a promise of digital technology goes unfulfilled, a fact that should encourage the sector to question its technological knowledge and beliefs.

Towards *low tech* innovation in music

The ADEME-ARCEP study concludes that the primary method for limiting the impact of digital technology is the implementation of digital sobriety policies, which begin by questioning the extent of the development of new products or services and with a reduction in or stabilisation of the amount of equipment. Extending the lifespan of devices, by placing eco-designed equipment on the market, by further developing the reconditioning and repair of equipment and by raising consumer awareness of this technology's environmental impact, with the aim of achieving greater digital sobriety, is an area where serious work is required.

For the music sector, the first part of implementing a digital sobriety policy consists of training professionals, artists, investors and fans in the impacts of digital services and, even more, on infrastructures and devices. This means no longer encouraging the

production of increasingly voluminous content that requires new machines and peripherals.

At the heart of an eco-design approach, even before applying good digital eco-design practices by simplifying interfaces, is a questioning of need and the avoidance of environmental impacts by abandoning the production of a service or tool that does not meet at least three of the UN Sustainable Development Goals.

Music is necessary for happiness on this earth and the sector fulfills an essential social function by arranging the connection between music and the public. But is it not possible to establish a new vision of innovation in music in a low-tech mode, one that is open, resilient, shared and repairable?

Low tech experiments in the music sector exist

In France, the Sarcus festival, which is no longer active, stands out for its commitment to limiting its capacity to 3,000 festival-goers, to not having artists travel by plane, to offering vegetarian and local food sourced from within a radius of 150 km, and to encouraging logging off by requiring festival-goers to leave their phones at the entrance.

In terms of recorded music, British company Evolution recently announced that it had manufactured the first vinyl made from sugar cane. French company Diggers Factory produce, sell and distribute vinyl pressed on demand in limited quantities and collaborate with responsible material and logistics suppliers, an approach that the founding team describes as "direct green pressing". The records are made from calcium-zinc-based vinyl pellets, a clean and recyclable material, while the packaging is printed with vegan ink.

Resonate.coop, an alternative platform to Spotify, has put in place a cooperative and responsible governance model in which artists, users and employees participate.

To give greater weight to this demonstration that alternative models are possible, the music sector must work collectively on shared solutions, placing artists, with their ability to communicate new visions, at the heart of the process is crucial to any renewal.

Co-designer and art historian **Camille Pène** helps cultural organisations respond to the challenges of digital, social and ecological transitions, by designing training courses, research and collaborative innovation systems. Since April 2020, she has been supporting cultural actors in their ecological transition, assisting them with adaptation and innovation as part of the Les Augures collective. She has collaborated with the likes of the Palais de Tokyo, the Cnap (the national centre for visual arts), the Orchestre national d'Ile-de-France, the Ministry of Culture, the Scène nationale Châteauvallon Liberté... An expert in issues relating to digital sobriety in culture, she runs the 'Augures Digital Responsible Lab in Culture' program of action research with the Ctrl S studio. Previously, she worked for ten years aiding technological innovation at a local level and in cultural and creative industries, for organisations such as La 27e Région, Paris & Co and Cap Digital, notably as director of the 'Futur en Seine' and 'Futur.e.s in Africa' festivals. She also worked as an exhibition assistant for MoMA, the Louvre and the Cartier Foundation.

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Part 2

Established Practices

The **Established Practices** section of this document provides an exploration of the different digital solutions and alternatives available in terms of musical production, communication and management of artistic activity. These can be used by all musicians and those around them wishing to reconsider their digital practices.
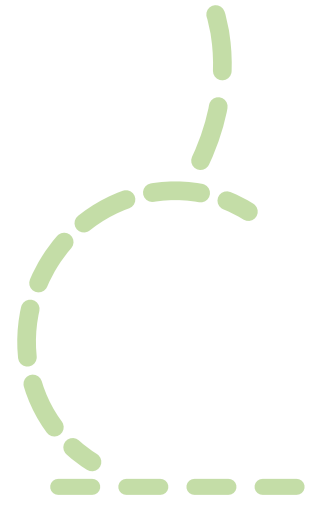
Everyday digital sobriety

We open this 'toolbox' section with an introduction to good digital practices for daily use. These tips, in addition to reducing the consumption of digital technology, apply to private or professional use, with the two often being similar. These actions can be quick and simple to implement while having interesting benefits, in terms of privacy, the fight against obsolescence and digital education. This first step can also facilitate contact with associations and collectives that can help us to go further down this path, while also politicising the subject. It's a way to counter the loneliness of screens and create interesting synergies. Artists have an important role to play, participating in and supporting collectives.

This list is organised in order of ease of implementation. Some solutions are more akin to improving privacy or using free software*. This is not always the case, but sobriety, privacy and free software often point in the same direction. Access to source code and the power to participate in the development of software make it possible to direct its evolution towards greater sobriety. We do not have this power when it comes to proprietary software* which most often follows a commercial logic of renewing paid licenses, leading to an increased demand for computing power. In addition, these alternatives often have greater interoperability, which avoids the lock-in and dependency effect found in proprietary software. It is a central element in the lifespan of electronic devices. Faced with the lack of awareness of digital pollution and the inadequate proposals for sobriety coming from dominant digital players, we must regain control over the tools to develop more sober solutions. Note that it is not necessary to be a developer to participate in free software projects: testing and providing feedback, sharing and training, are valuable aids for the communities that develop these alternatives.

These proposals are not exhaustive, and are of interest in terms of:

A reduction in the impact of energy use 🌿

Reduction of energy consumption during use, increase in the lifespan of devices, fight against obsolescence.

A contribution to social justice and activism ⚖️

Fair remuneration, free access, accessibility to all without barriers, fight against discrimination.

Privacy Protection 🔍

Protection of private data, limiting data collection.

Improved security 🔒

Online user security.

Facilitation of learning 📖

Ease of use or learning.

What if I have nothing to hide?

We often hear this phrase used to explain that data collection is not really a problem. You should keep in mind that even if you think you have nothing to hide, your loved ones may have information to protect which could be exposed by software that does not respect your privacy. Data collected today may not pose an immediate threat to you, but it is difficult to predict who will use this data in ten years and for what purpose. In addition, faced with the increase in computer hacking, limiting data collection provides an extra layer of security. Another issue is that of the repeated use and storage of our data. This consumes energy and the data can be used in many activities which themselves consume more data (targeted advertising, surveillance, statistics, etc.). They are also mainly used for advertising purposes and feed our consumption habits. In short, the non-collection of data is undoubtedly the most energy-efficient solution.

The browser

Browser software is central to our daily routines, with the internet now at the heart of our digital practices. It makes sense therefore to start reducing our consumption through this tool. Our proposals contribute more to improving privacy, but limiting data collection and blocking advertisements makes it possible to reduce the weight of the pages and therefore the consumption of our browsing, even if this remains limited.

It is important to avoid the use of *Google Chrome*, *Microsoft Edge* or *Safari*, which are known to have little respect for the privacy of their users[50]. **Firefox** is a browser that offers more possibilities for limiting tracking and protecting privacy. **Firefox focus** is a good alternative on smartphones. **Librewolf** is a version of Firefox preconfigured with security settings, but which can prevent certain sites from working (probably due to too many blocked requests).
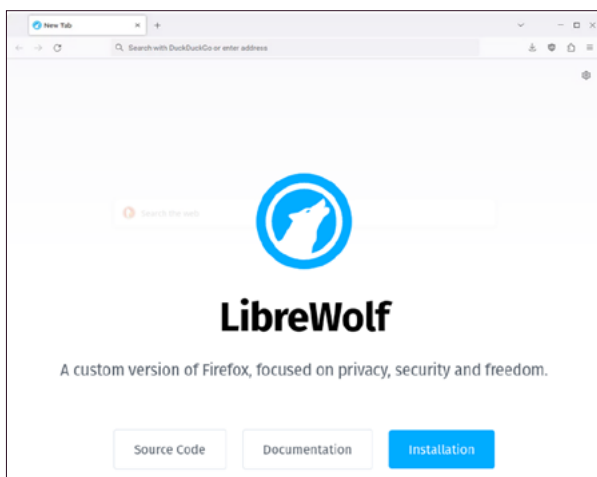
In addition to changing browsers, it may be worth installing extensions on Firefox in order to increase security and protect privacy:

- **uBlock Origin** blocks advertisements, which reduces the weight of pages (present by default on *LibreWolf*),

- **low—web** automatically reduces the quality of videos,

- **HTTPS Everywhere** forces a secure connection,

- **ClearURLs** prevents tracking via URLs,

- **Privacy Redirect** redirects GAFAM sites to more respectful alternatives.

As an example of the impact of ad blocking, a simple comparison on a popular public site allows us to note a marked difference: for a press site like billboard.com, by opening the home page on 04/10/2023, we obtain:

- Without an ad blocker: 17 MB of data transferred,
- With an ad blocker: 9 MB.

This observation is similar for many consumer websites. Advertising and data collection are the main reasons for this gap. There are more detailed guides you can consult online like **Gofoss**, **PrivacyTools** and **Wikilibriste** (in French) to delve deeper into this topic.

50   Doffman, Z. (s. d.). Why You Shouldn't Use Google Chrome After New Privacy Disclosure. Forbes.
https://www.forbes.com/sites/zakdoffman/2021/03/20/stop-using-google-chrome-on-apple-iphone-12-pro-max-ipad-and-macbook-pro/

Associations and collectives to the rescue

Once the browser is configured, you should pay attention to the online services used and the sites you visit. If possible, it is best to avoid GAFAM services. We will deal with social networks later, but whether it is to store, share, or edit files, send emails or collaborate, it is preferable to favour more ethical services. The latter do not collect your data, which limits the energy consumption of navigation and avoids misuse of data which itself results in further data (advertising, spam, artificial intelligence).

There are many associations and collectives that offer alternative services to Google Drive or Microsoft Teams: **l'Autre Net** (France), **la Contre-Voie** (France), **Devol** (Italy), **Disroot** (Netherlands), **Indiehoster** (France), **Nubo** (Belgium), **Ouvaton** (France), **Systemli** (Germany), **Zaclys** (France) and many others, notably through lists like the one compiled by French collective Chatons. All of these initiatives offer services (some free, others paid but at a reasonable price) which are viable alternatives for private or professional use. The **Framasoft** association launched the Chatons movement to encourage a greater diversity of alternative services from different sources. This logic of decentralisation is vital, because instead of overly powerful web giants, we need a multitude of players offering freedom of choice.

Even when services are free, we recommend making a donation whenever possible, in order to support associations that rely partly on voluntary work. Note that it is possible as an artist to help promote these services to create a virtuous circle. Another advantage of this approach is the educational aspect. These collectives often offer documentation, meetings, training and events that allow you to better understand digital technology and its attendant challenges and to learn to use ethical alternatives. This popular education creates a conducive environment for thinking about and understanding digital technology collectively rather than being subjected to it. Do not hesitate to contact them for support, especially if you are making this change for a group, a collective or a company.

Besides Chatons, there are many online portals that allow you to search for more associations and places that promote ethical software and popular education. For example:

Près de chez vous, **Carte Makery**, **France Tiers Lieux**, **Movilab**, **Agenda du libre**, **Repair Cafe**

These associations often offer alternatives for the uses of digital technology that we have outlined below.

Search engines

We have become accustomed to having very personalised results via search engines, but this comes at the expense of our privacy. Google's search engine monopoly should make us wary, since we're not protected from arbitrary decisions on the part of the company which could make the relevance of the results more than questionable. This is already partly the case, particularly with the increase in advertising results due to the integration of artificial intelligence[51]. **DuckDuckgo** and **StartPage** are search engines that do not collect personalised data. Their results may certainly be less relevant, but avoid personalised targeting of advertising, a loss of control over our data and the filter bubble effect. Associations also offer search engine services like **Zaclys**. Changing our search habits means accepting that we sometimes have to search more to obtain the expected results. Other habits can help reduce the energy impact of your searches: you can use favourites (or bookmarks) to save the sites you visit the most. In fact, clicking on a favourite consumes less energy than carrying out a search.

Email

Email is a striking example of the power GAFAM has when it comes to monopolising open technology. One email address can communicate with another without barriers. You can send an email from *Gmail* to your colleague who uses *Orange*. The strength of *Hotmail/Outlook*, *Gmail*, *Apple Mail* was to make us go through one of their accounts to use a service that should be available universally. If you use Gmail, the second most popular service[52], Google can collect data on your habits[53] (hence the free offer) and display advertising to you[54]. The company can also decide overnight whether we will still be able to access our emails or not[55], or to charge for this service. In the case of a monopoly, the price may very well be extortionate (as was the case for Google Maps, for example), or projects may be stopped without real consideration for users[56]. However, sending an email can easily be done outside of Google, Microsoft or Apple. Likewise, by using Outlook for example, I force the recipients of my emails to send data to Microsoft. However, there are many alternatives which may be free and above all more ethical.

Mailbox is a secure electronic mailbox developed in Germany which is financed solely by paying users. **Tutanota**, also hosted in Germany, offers an accessible and ergonomic interface which allows you to encrypt your emails. Security is also the priority of the company, which favours privacy. Financing is mainly done through paying users, but there is a free service. **Disroot** is an activist service for free email accounts, as well as other online services. Once again, associations offer access to more ethical solutions, such as **Chatons**, who provide a list of available services.

51 Pelt, M. (9 mars 2023). Google search is bad and getting worse. Here's how search is evolving in the era of AI. Business Insider Nederland. **https://www.businessinsider.nl/google-search-is-bad-and-getting-worse-heres-how-search-is-evolving-in-the-era-of-ai/**

52 Email Client Market Share and Popularity. (s. d.). Litmus. **https://www.litmus.com/email-client-market-share/**

53 O'Flaherty, K. (9 mai 2021). How private is your Gmail, and should you switch? The Observer. **https://www.theguardian.com/technology/2021/may/09/how-private-is-your-gmail-and-should-you-switch**

54 *Lomas, N. (2022, 24 août). Google faces « spam ads » ePrivacy complaint in France. TechCrunch.* **https://techcrunch.com/2022/08/24/gmail-spam-ads-eprivacy-complaint/**

55 Google can completely shut down your Google account. Here's the info you need. (10 mars 2023). Android Authority. **https://www.androidauthority.com/google-account-banned-1054640/**

56 Ogden, C. (2023, 30 septembre). Killed by Google. Killed by Google. **https://killedbygoogle.com**
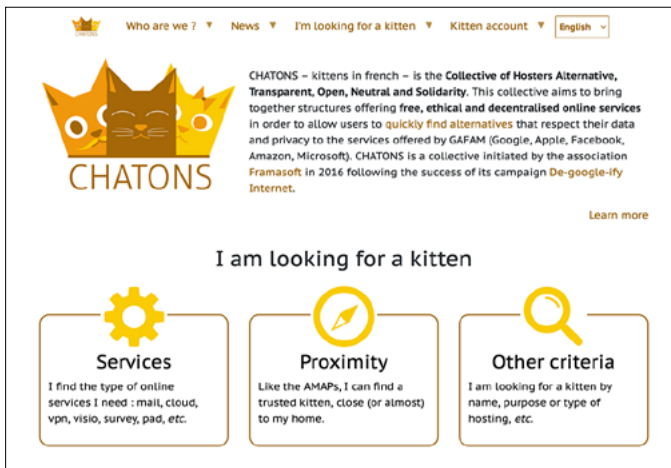
Les Chatons allow you to easily find a more ethical service

The last, more technical option is to purchase a domain name and create a dedicated email account. While the majority of hosts offer this service, we recommend getting supported if you're making this change. All these services are accessible via a browser or an application. It is important to choose an application that avoids sending data to GAFAM, and therefore to avoid *Gmail*, *Outlook* and *Apple Mail* interfaces or software. There are alternatives for managing your emails:

- **Thunderbird** (Windows, MacOS, Linux),

- **K9-mail** (android),

- **Tutanota** offers an application compatible with iOS.

Other habits can help reduce the energy impact of emails:

- Limiting the number of emails sent remains the simplest solution,

- Avoid large attachments. Compress them or send them with a sharing service like **Swiss Transfer** (an ethical alternative to WeTransfer),

- Mute notifications,

- Avoid subscribing to too many newsletters,

- Block spam,

- Write your emails in text format instead of HTML,

- Delete unnecessary emails.

- Acting on emails remains an individual gesture. It does not allow for a significant mass effect on digital pollution, but the benefit to privacy makes it worth making this change. It also represents an easy step towards imagining a freer and more ethical digital world.

Software

There are opportunities outside the web to limit the consumption of our software, improve the protection of our privacy and avoid compatibility problems. Free software has the major advantage of being more durable because it is generally simpler to make it compatible with old machines. This is not the case for proprietary software which requires regular renewal in the form of new versions and the purchase of new licenses. Additionally, many proprietary software programs connect to the internet to transmit data and are sometimes inaccessible without a connection.

Office Suites

LibreOffice allows you to replace word processing tools such as the Microsoft Office suite or iWork. Many guides to getting started exist, with the official guide being a very good introduction. In this area too, popular education via collectives is a very good gateway to training. If you are used to proprietary office suites, the difference is not that significant and their files work on LibreOffice. Although there may be minimal changes in formats, they do not cause problems in the majority of cases.

Graphic design and images

Free software now offers many alternatives to proprietary graphic design tools. This market is mainly dominated by Adobe[57], which is not considered a web giant (GAFAM), but shares the same values as the latter (data collection, security breaches[58], establishing a monopoly[59], rising pricing). Here too, free alternatives work for the majority of amateur or professional uses. As is often the case with graphics tools, it is more a question of changing habits than an issue with the software. You will find everything you need to produce professional visuals with this software:

- **Gimp** as an alternative to Photoshop (photo processing),

- **Inkscape** as an alternative to Illustrator (vector drawing),

- **Krita** for digital painting,

- **Scribus** as an alternative to InDesign,

- **Excalidraw** to create diagrams.

The objective here is not to offer a complete guide to the available software as they offer many options and their respective sites and communities offer valuable help in getting started.

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57   Global graphics software market share by vendor 2023. (s. d.). Statista.
     https://www.statista.com/statistics/1369176/worldwide-graphics-market-share/ Binder, M. (25 octobre 2019)

58   Adobe exposed nearly 7.5 million Creative Cloud accounts to the public. Mashable. **https://mashable.com/article/adobe-creative-cloud-accounts-exposed**

59   Singh, S. (8 août 2023). European Authorities Investigate Adobe-Figma Merger for Monopoly Concerns. TechStory.
     https://techstory.in/european-authorities-investigate-adobe-figma-merger-for-monopoly-concerns/

Audio and video

Video consumes more bandwidth than other media, but there are several techniques to limit its impact:

- Limiting video resolution

- Using alternatives to platforms like YouTube (with an extension like **Privacy Redirect**, **FreeTube** or **PeerTube**),

- Avoiding using video to listen to music, using **YouTube audio only** for example

- Limiting streaming. If you watch a video multiple times, it's best to do it locally and download the video[60],

- Avoiding watching videos over a 3G, 4G or 5G connection. A Wi-Fi or wired connection is preferable,

- Disabling autoplay,

- Compressing the videos you post.

When it comes to compression, a tool like **Handbrake** allows you to obtain a satisfactory result. There are generally few cases where high-definition video is necessary, so it is important to compress video files before uploading them. On the production side, there are free alternatives that allow you to avoid the costs of frequently expensive editing software, such as **Kdenlive** or **OpenShot**. Note that for more advanced effects, **Blender**, which has become increasingly powerful, is now used by professional studios[61].

The recommendations are identical concerning audio files. Compression, when usage permits, is a preferred option. In the case of streaming, on the majority of platforms (Spotify, Deezer, Youtube Music, Apple Music, Tidal, Qobuz) there is an "offline" mode which allows you to avoid reloading a song entirely each time you listen. It is also possible to reduce the sound quality on listening platforms such as Deezer or Spotify. The latter also offers a "data saver" mode which hides video effects, audio and video clips on the home page and sets the audio quality to low. Whether for video or audio, it is best to watch or listen to media locally, that is, to download it, ideally via a cable or Wi-Fi connection.

Streaming and downloading are often considered two separate processes, but in both cases a file is downloaded. Streaming is the downloading of content with continuous playback. In other words, it allows you to start playing the file while it is downloading. This distinction is very well described in the Grise Bouille comic strip by Gee, **An Update on Streaming** (in French)

60   **https://www.rollingstone.com/music/music-features/earth-day-climate-change-streaming-downloading-ajr-1339228/**

61   *Foundation, B. (s. d.). "2D Isn't Dead, It Just Became Something Different": Using Blender For Wolfwalkers. *blender.org*. https://www.blender.org/ user-stories/2d-isnt-dead-it-just-became-something-different-using-blender-for-wolfwalkers/*

Messaging

This section on messaging necessitates a brief history lesson in order to understand why it is important to promote decentralised and free systems. Many popular messaging platforms were based on a communications protocol called XMPP (Extensible Messaging and Presence Protocol). MSN (a Microsoft messaging service that was popular in the 2000s), Hangout (Google) and Messenger (Facebook/META) were built on this model. XMPP worked like email, meaning that users using services outside this protocol could communicate with each other. Once they had acquired enough users, the web giants modified their protocols to "lock" them into their systems and create monopolies. Hence the importance we give to open services, which give us choice[62] and the possibility of more sober and ethical alternatives.

If possible, it is best to avoid services like Facebook Messenger, WhatsApp[63] (owned by Facebook/META) and Telegram. These services are owned by centralised companies that collect data and are difficult to trust. Just as is the case with social networks, it is difficult to change your habits, especially when family, friends or professional circles also use these tools. **Signal** is an initiative based on a more privacy-friendly solution and developed by a foundation and not a company. It is often the most recommended application, even if it has the same fault as all the most popular applications: centralisation. The Signal team could very well change their privacy policy and start collecting data. There would then be few options for changing applications and finding an alternative.

DeltaChat is a messaging service based on emails. The interface is similar to that of a messaging service, which facilitates rapid communication. The advantage of using emails is that you can communicate with DeltaChat users, but also with everyone who has an email address. Other decentralised alternatives are in development like **Briar** and **Cwtch** and deserve to be tested, even if they still have few users. This may be an opportunity to invite those around you or your community to join you.

62   How to Kill a Decentralised Network (such as the Fediverse). (23 June 2023). **https://ploum.net/2023-06-23-how-to-kill-decentralised-networks.html**
     Gebhart, B. B. and G. (13 October 2016)

63   *Where WhatsApp Went Wrong: EFF's Four Biggest Security Concerns. Electronic Frontier Foundation.*
     https://www.eff.org/deeplinks/2016/10/where-whatsapp-went-wrong-effs-four-biggest-security-concerns

Maps and navigation

OpenStreetMap is a collaborative mapping tool, a bit like the Wikipedia of maps. The data is added and updated by an international community thanks to a free license. Above, we mentioned the change in the economic model of Google Maps which has made its use expensive for many companies and especially for public institutions. This application is also a data collection tool and generates targeted advertisements. The use of OpenStreetMap allows you to reclaim your data while offering a more collaborative vision of mapping.

Online guides allow you to get to grips with the tool and contribute to it. As is often the case, there are collectives and associations that can make it easier to get started, and which organise mapping events.

Passwords

The risks of piracy continue to increase with the acceleration in the digitisation of our daily lives and our societies. Learning to secure your accounts and having the right responses when it comes to anticipating attacks (phishing, viruses, etc.) has become essential. This recommendation is not necessarily linked to digital sobriety and privacy, but it remains an important reminder that will enable everyone to benefit from safer digital technology.

The **CNIL** (an independent French administrative regulatory body) has published an **article** (in French) online which does an excellent job of explaining the need for strong passwords for your own security. In addition to the information on passwords, we recommend reading the **CNIL digital hygiene guide** (also in French), to help better predict the various risks on the internet (cyber-harassment, phishing, etc.).

Finally, to facilitate your admin, a password manager is strongly recommended:

- **Bitwarden**

- **KeepassXC** (guide) with an **extension for Firefox**

You can go further with **double authentication** (a security code in addition to a password), which is possible with an application like **Aegis**. Once again, it is preferable to get in contact with associations and groups to get help in securing your online life.

Websites and self-hosting

We have discussed numerous online services offered by associations, mainly based on free software such as GNU/Linux. With technical knowledge and support, you can install your own services on your server*. For example, online storage services often rely on **Nextcloud** software (equivalent to Google Drive). It is possible to download this software, which offers maximum control to its user, and install it yourself on a server. This is a fairly advanced stage, which can be set as a long-term objective. Furthermore, **Yunohost** is software that allows you to easily self-host online services and has a **complete guide**. Services dedicated to music like **Ampache** or **Funkwhale** can also be self-hosted.

The advantage of having a self-hosted platform or website is not having to depend solely on third-party services such as social networks or website builders (Wix, Webflow, Weebly, etc.). The terms of service of these companies can change at any time and it is possible to see your online presence quickly collapse. Several reasons exist for this: account hacking (GAFAM are very reluctant to help their users), a change of rules, banning and censorship[64]. A change in pricing policy can also occur unexpectedly with these services. A website is like your online home[65] and it's up to you to have greater control over it without relying on a centralised company. There remains the problem of technical implementation and cost. Here again, there are associations that offer tools and support. Carrying out a website project with freelancers or with a web agency is often more expensive, but the result will be more personalised. Another option that is too rarely imagined is that of sharing the costs between artists to own a common website. It is also important to get closer to service providers that have good practices in terms of accessibility and eco-design.

> ### The examples of PeerTube and Ampache
>
> Several groups and associations have decided to regain control over the distribution of their music and video content. For example, the **CEM** (Centre d'Expressions Musicales) and **Slowfest** have set up the PeerTube software on servers to replace YouTube for broadcasting their activities.

Going further

Getting help is recommended if you want to avoid getting lost among all the possible options, but if you want to go further, you will find inspiration via these links:

Wikilibriste, **Awesome privacy**, **Prism Break**, **Privacy tools**, **Framalibre**, **Gofoss**

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64   Milman, O. (22 septembre 2020). Facebook suspends environmental groups despite vow to fight misinformation. The Guardian.
     https://www.theguardian.com/environment/2020/sep/22/facebook-climate-change-environment-groups-suspended

65   Les Oeuvres vives - Livre Blanc "Acteurs culturels : des pistes pour un numérique plus responsable". (23 janvier 2023).
     https://www.tmnlab.com/2023/01/23/livre-blanc-acteurs-culturels-des-pistes-pour-un-numerique-plus-responsable/

Become aware of your digital usage

Becoming aware of our digital usage and its consequences is an important step in trying to reduce it to the essentials. The use of digital technology has become omnipresent, even though its harmful consequences are well documented[66]. Understanding the resources necessary to make the best use of digital means considering the environmental impact of the production and use of our devices, in order to be able to choose between useful and superfluous services. Questioning usage is an essential starting point in this process.

Aside from the tools we use, we can adopt habits that allow us to use fewer electronic devices, which has the advantage of extending their lifespan while having beneficial effects on health and free time. A few recommendations and habits can change your daily life:

- Turning off notifications

- Limiting the software and number of applications you use

- Using mobile versions of the services instead of applications. The majority of sites now have enhanced mobile versions that allow applications to be replaced.

- Limiting the number of applications accessible from the home screen,

- Turning off GPS/Bluetooth/internet when not needed,

- Favouring a cable connection (Ethernet) which consumes less than a Wi-Fi connection, which itself consumes less than a 3G/4G/5G connection,

- Turning off screens in the evening, which helps you to sleep.

Understanding the issues in a fun and interactive way

The Digital Collage is a very good introduction to understanding digital infrastructure and its consequences on our planet. The **Econ[u]m** game is oriented towards taking action for more responsible digital technology.

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66   Hoehe, M. R. et Thibaut, F. (2020). Going digital: how technology use may influence human brains and behavior. Dialogues in Clinical Neuroscience, 22(2), 9397.
https://doi.org/10.31887/DCNS.2020.22.2/mhoehe

For a collective culture of user-friendly digital technology

While having had to quickly adapt its practices to digital technology, the cultural sector is also suffering its harmful consequences (dematerialisation, streaming, copyright, monopolies, etc.). It is also difficult to ask artists to make an effort at their own level while many major acts do little or nothing, despite the means at their disposal. The routes that we are outlining here are with a view to freeing ourselves from monopolies in order to emancipate ourselves, and to a long-term vision for regaining control of digital tools.

While we recommend the application of the recommendations in this guide, the main objective is not to push artists to make individual changes, but to create stimulating synergies with communities that are specialised in this field. It is an approach that is the opposite of digital technology as we know it, which tends to isolate us. It aims to create a friendly, collective space, where digital technology represents a support and not an end in itself. These cross-sector collaborations can be a source of inspiration and bring mutual benefits for the artists and operators involved.

Social networks

Social networks have become central tools for a multitude of uses in the music sector. Unlike changing browsers, changing social networks means losing a community that has often been built over long hours of work. This is the magic of the social media model: we work for them for free, attracting more and more users to their platforms. Their economic model is to accumulate users and monopolise their time in order to collect data - your data - which is resold at a high price[67]. This model gives rise to a multitude of scandals that grow more serious over time[68]. In addition to the effect on our private lives, social networks have more wide-ranging impacts on our societies at the democratic[69], geopolitical[70] and human levels. Added to this is the operation of algorithms that promote hateful behavior to create a buzz. It is now well documented that commercial social networks promote extreme discourse and undesirable aspects of our society (hate, racism, climate scepticism). Just like many digital tools, the most popular social networks are based in the United States, a country where privacy is less protected than in Europe[71]. TikTok (from Chinese group Byte Dance) is the only

67   Meta Reports Fourth Quarter and Full Year 2022 Results.
     https://investor.fb.com/investor-news/press-release-details/2023/Meta-Reports-Fourth-Quarter-and-Full-Year-2022-Results/default.aspx

68   A timeline of trouble: Facebook's privacy record and regulatory fines. (4 August 2021). Guild blog: community building best practices, trends and insights.
     http://guild.co/blog/complete-list-timeline-of-facebook-scandals/

69   Mark Scott (2019) *Cambridge Analytica did work for Brexit groups, says ex-staffer*, Politico, 30 July 2019
     https://www.politico.eu/article/cambridge-analytica-leave-eu-ukip-brexit-facebook/

70   Troll farms reached 140 million Americans a month on Facebook before 2020 election, internal report shows. MIT Technology Review.
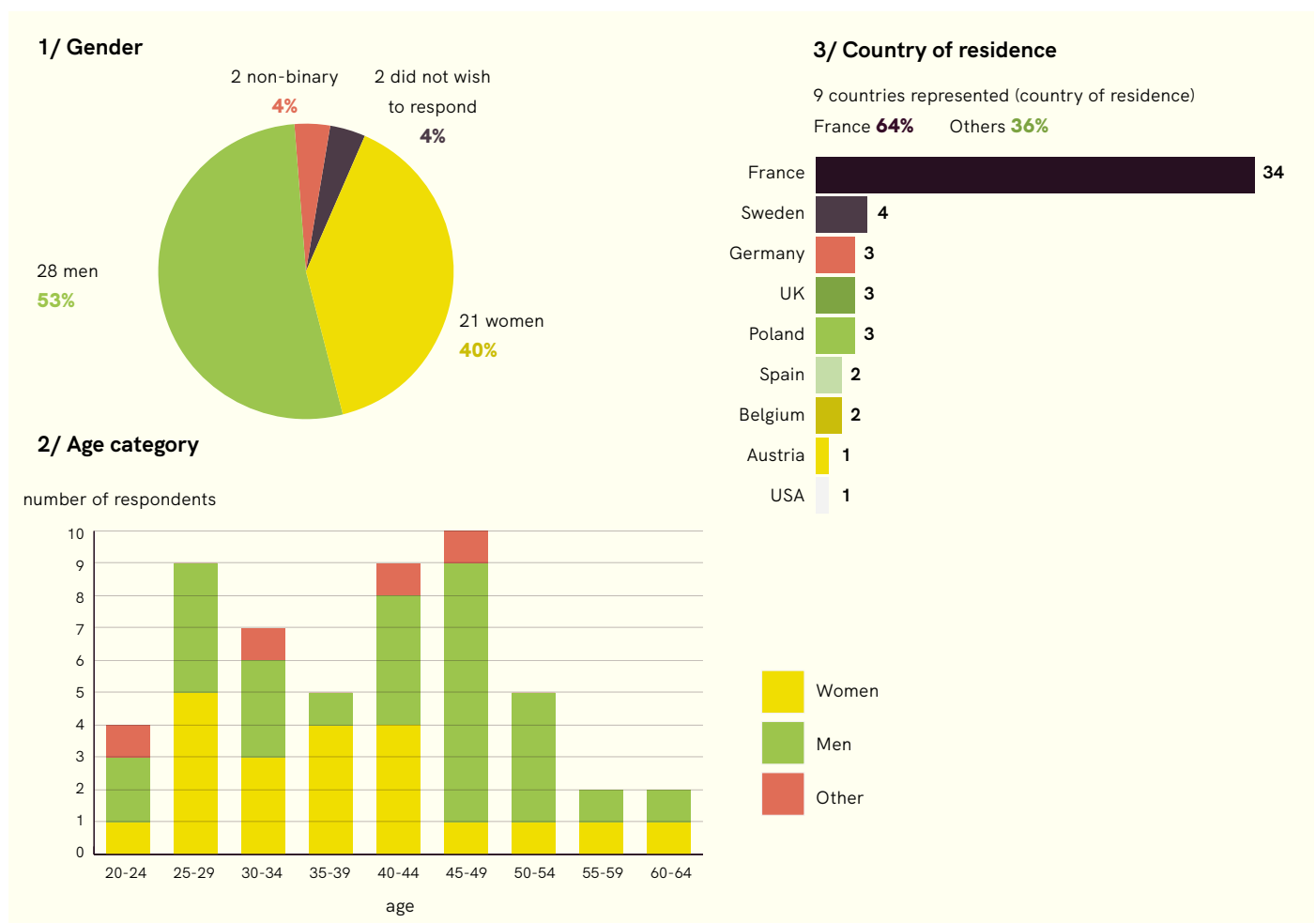   https://www.technologyreview.com/2021/09/16/1035851/facebook-troll-farms-report-us-2020-election/

71   *Zuboff, S. (2019). The age of surveillance capitalism: the fight for a human future at the new frontier of power (First edition). PublicAffairs.*

exception, but China is not known for its privacy either[72]. Not to mention that we have no control over the evolution of these platforms, as the case of Twitter (now X) has shown since its acquisition by Elon Musk[73]. This economic model is also problematic from an environmental point of view. Networks constantly seek to capture our attention and push us to use their services for as long as possible. This principle is opposed to that of digital sobriety which would consist of drastically reducing the time spent on digital services.

Because it allows them to have a more direct relationship with their communities, the use of social networks is difficult to avoid for artists.

Infographie issue d'une enquête menée par The Green Room auprès de 53 musicien·nes entre avril et mars 2023

1/ Gender

2 non-binary **4%**

2 did not wish to respond **4%**

28 men **53%**

21 women **40%**

2/ Age category

number of respondents

Legend:
- Women
- Men
- Other

age

3/ Country of residence

9 countries represented (country of residence)
France **64%**   Others **36%**

Country	Value
France	34
Sweden	4
Germany	3
UK	3
Poland	3
Spain	2
Belgium	2
Austria	1
USA	1

72   *The vaguely dystopian technology fueling China's Olympic Games. (1 February 2022). Rest of World.*
     https://restofworld.org/2022/the-technology-fueling-beijing-olympic-games/

73   Stringer, A. S. and A. (19 September 2023). Elon Musk's Twitter (now X): Everything you need to know, from layoffs to verification. TechCrunch.
     https://techcrunch.com/2023/09/19/elon-musk-twitter-everything-you-need-to-know/

4/ I feel I should play a role in the ecological transition of the music sector

number of responses
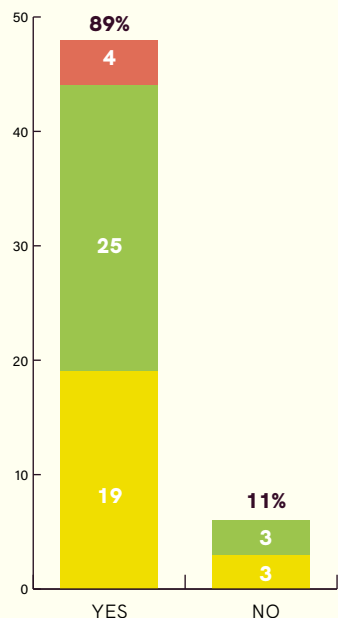
5/ I think I can play a role

number of responses
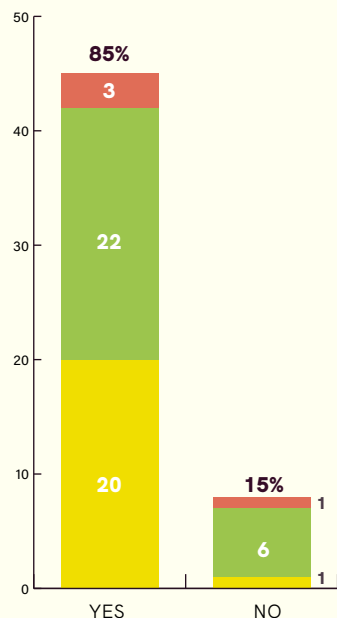
6/ I have already taken initiatives in terms of ecological transition as part of my career (my concerts or in the production/distribution of my music)

number of responses
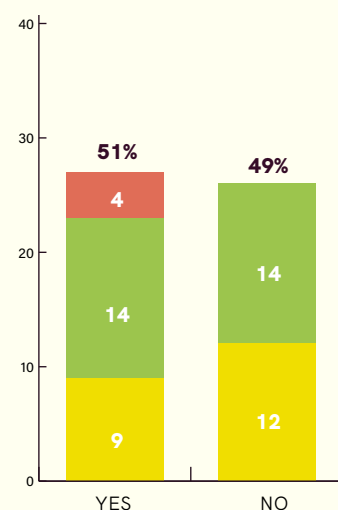
7/ Are you present on the following social networks and platforms (as an artistic project)?

Drooble — 0%
Facebook — 94%
Instagram — 85%
Linkedin — 43%
Mastodon — 4%
Pinterest — 11%
Reddit — 0%
ReverbNation — 2%
Snapchat — 6%
SoundCloud — 55%
Tiktok — 28%
Tumblr — 6%
Twitter — 43%
Youtube — 79%
None — 2%
Other — 15%
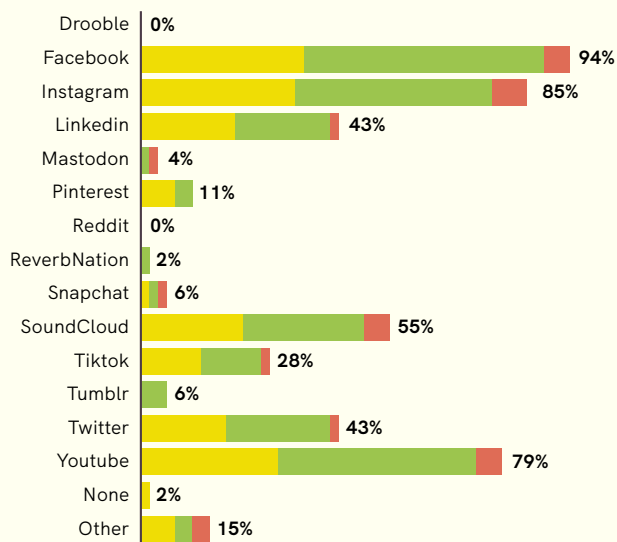
8/ How much time do you spend each day on social networks to promote your work?

number of respondents

none — 8%
30min or less — 45%
30min to 1h — 30%
1 to 3h — 17%
3 to 5h — 0%
more than 5h — 0%
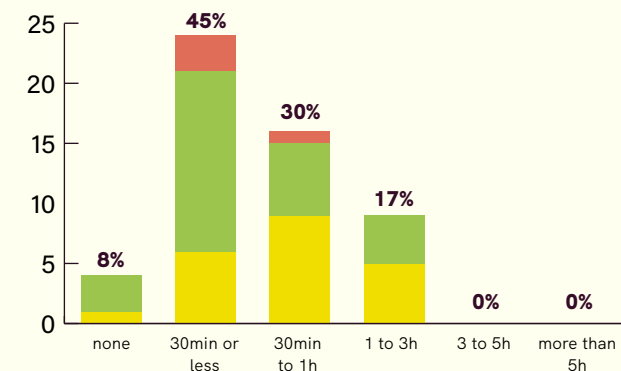
9/ Are you aware of your rights regarding the distribution of your works and content online?
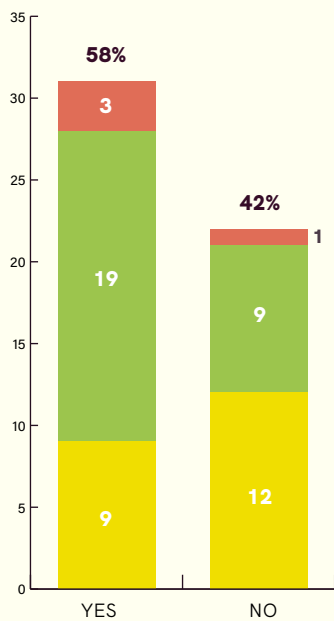
10/ On which stream/video platforms are you present?

Platform	Percentage
Amazon Music	36%
Apple Music	66%
BandCamp	64%
BBC Sounds	4%
BeatPort	19%
Deezer	68%
Google Play Music	26%
MixCloud	17%
Qobuz	26%
Soundcloud	62%
Spotify	79%
Tidal	30%
Youtube	85%
Youtube Music	47%
None	0%
Other	8%

11/ Are you aware of their environmental impact ?

DEFINITELY	I THINK SO	I AM NOT SURE	NOT AT ALL
8%	42%	28%	23%

However, it is preferable to do without your networks as much as possible or to limit their usage. You can therefore limit your presence to one or two networks, refining the approach according to where your audience is located. 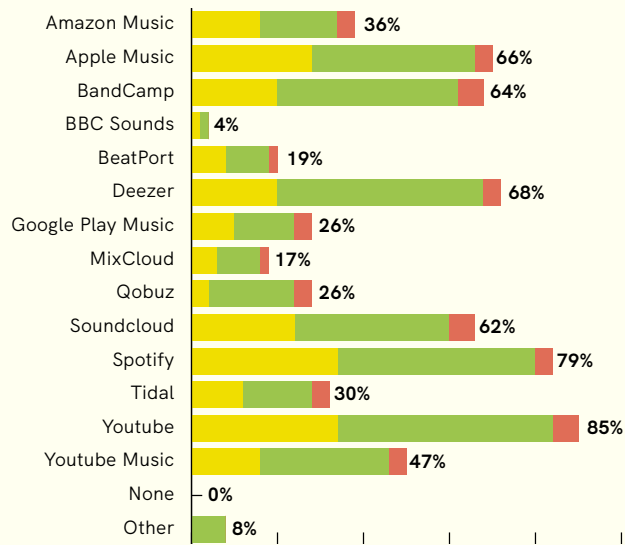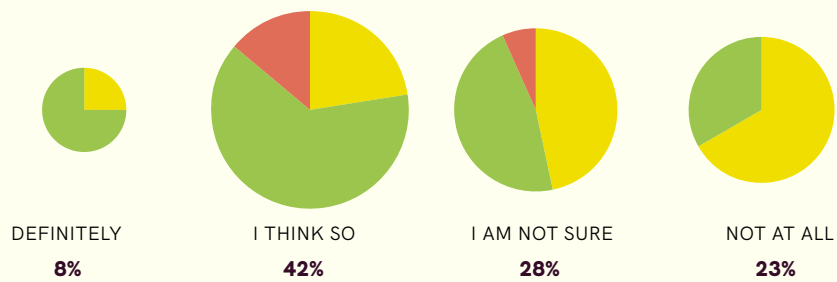If it's not entirely possible, and you need online communication support, we recommend using more ethical alternatives alongside or instead of them, and only as much as is necessary.

In Europe, there is no dominant player in the commercial social media sector which, paradoxically, is a fortunate situation to be in, because many more ethical alternatives are emerging and developing in response to this situation. This is particularly the case of the federated universe, or Fediverse, a free and open-source alternative to commercial social networks. On the Fediverse network, which is decentralised and federated, everyone can manage a server, also called an "instance", and thus offer services to a community which can easily communicate with other instances. It's as if any internet user or organisation could manage their own server with their own version of Facebook and invite their friends to join them while having the possibility of communicating with other copies of Facebook managed by other people (known as interoperability). Kindness and the reduction of algorithms are at the heart of this software. The Fediverse is not optimised to capture the attention of internet users and it is free of filters which decide which content internet users will be able to see in their timeline and which content will be censored.

Fediverse provides a technical solution for regulating the excesses of social networks and their business models. By decentralising the organisation of networks and allowing a connection between all the different platforms, the oligopoly effect is avoided. It is possible to follow users from another network and easily change instances if their conditions no longer suit. It is entirely possible to self-host an instance and have even more control.

This way of operating has ethical virtues far beyond those of the networks offered by GAFAM, but they suffer from a significant weakness for artists: the absence of mass reach. For the time being, the Fediverse social networks still have few active users (11,708,102 users as of 09/04/23[74]). However, this is starting to change, particularly for Mastodon which has seen a sharp increase in its users following the repeated X/Twitter scandals. However, the figures still remain marginal compared to the 353.9 million accounts on X/Twitter[75]. This low number can be a problem for communication, but just like a website, these platforms offer a fallback solution when GAFAM changes the rules without really taking into account the consequences for users. This small number also presents advantages, the communities remain more benevolent and the excesses of Facebook and X/Twitter (cyberharassment, online hate speech,

conspiracy theories) are still very rare in the Fediverse, the functioning of which greatly limits these phenomena (using more extensive blocking functionality). Provided you choose your forum carefully (see box below), this niche effect can be interesting for artists that desire a more limited and respectful audience.

How to choose the best instance for you

The way *Fediverse* works allows you to host your own social network, which has enabled many associations and activists to start their own networks and offer a space for free discussion that respects privacy. But the opposite effect also exists, and the freedom of speech of certain authorities serves much less benevolent interests. The emblematic example is *Truth Social*, a *Mastodon* instance created by Donald Trump after his exclusion from *X/Twitter*. (Note that *X/Twitter* has significantly loosened its moderation policy and that hate speech has increased sharply since the takeover by Elon Musk[76]). Within this free framework, it is possible to block an instance in order to avoid harassment, hence why it is important to choose your instance carefully and join a space that blocks and moderates inappropriate content. Tools exist to help make an informed choice[77].

74   Lostinlight. About Fediverse - Fediverse.Party - explore federated networks. **https://fediverse.party**

75   X/Twitter: number of users worldwide 2024. Statista. **https://www.statista.com/statistics/303681/twitter-users-worldwide/**

76   Twitter fails to act on 99% of Twitter Blue accounts tweeting hate. (18 September 2023). Center for Countering Digital Hate | CCDH.
   https://counterhate.com/research/twitter-fails-to-act-on-twitter-blue-accounts-tweeting-hate/

77   To the Fediverse! **https://www.fediverse.to/**

As with digital tools, the role of the Fediverse is to highlight the power of users on a platform and not the other way around. These are the strengths of a network. Artists could play a pioneering role in encouraging their communities to migrate to more virtuous networks. In fact, commercial social networks generally have Fediverse equivalents:

- Facebook → **Plemora**, **Friendica**

- Twitter/X → **Mastodon**

- Facebook Event → **Mobilizon**

- Medium → **Writefreely**

- Instagram → **Pixelfeed**

- Plateformes de streaming audio → **Funkwhale**

- Youtube → **Peertube**

- Reddit → **Lemmy**

Examples of clubs in Berlin and Mobilizon

Ideally, artists or media people would join the Fediverse to make it more popular. The debate over whether the Fediverse needs to be as influential as commercial social networks remains open: will the values of openness and equality still be present if global celebrities start using the Fediverse? While this question remains unresolved, the freedom offered by decentralisation always allows alternatives to be put in place. One such initiative has come from several Berlin clubs who have tried to use *Mobilizon* in a bid to free themselves from a reliance on Facebook Events for promoting their events[78]. It is possible to learn more in the ARTE documentary *Under the Radar: Covering Your Online Tracks*.

78   Joseph, Miha et Thommes, M. (12 January 2021). Berlin, let's take back control of our events! **h**
     ttps://media.ccc.de/v/r3c-oio-241-berlin-let-s-take-back-control-of-our-events-

Operating systems

Free and commons-based software: necessary concepts for understanding our approach

The meagre number of sober digital solutions currently available stems in part from a lack of control over our digital tools. As we saw in the **State of Play section**, a small number of players control digital technology and their practical and historical economic models do not allow us to have confidence in their actions to "green" the digital world. We believe that free software and the creation of commons* are a necessary step in allowing us collectively to regain control over creative tools. This step is essential to achieving the production of more economical and durable tools. It is also a necessary change if we want to put a brake on the speed imposed by the digital technology that the web giants are developing.

"A common designates a resource produced and/or maintained collectively by a community of diverse participants, and governed by rules which ensure its collective and shared character. It is said to be digital when the resource is dematerialised: software, database, digital content (text, image, video and/or sound), etc. The use of the resource by some does not limit the possibilities of use by others (the resource is non-competitive). Its preservation does not involve reserving the right of use to a restricted community (the resource is non-exclusive). **Labo Société Numérique de l'ANCT**

The commons follow principles of self-governance and collective action. Collective action means that communities determine what data is digitised, its veracity, its security, and its usefulness for human rights and environmental policies (as opposed to the logics of extraction and obsolescence[79]).

Another, more difficult, step is the one that offers the most possibilities: the transition to GNU/Linux, a free operating system. The market for consumer operating systems is divided between two companies: Microsoft (Windows) and Apple (macOS), while Google is increasingly present with ChromeOS[80]. What these three operating systems have in common is not putting respect for privacy and the fight against obsolescence at the centre of their development. On the contrary, they are increasingly hungry for personal data and it is necessary for users to configure their operating system after installation to maintain a minimum of privacy. In addition, their successive updates are always accompanied by a demand for space and increased power, which strongly contributes to software and hardware obsolescence.

79 Thomas, D. (14 October 2021). ZINE: Commoning: An alternative governance paradigm for our digital futures. mctd.ac.uk.
    https://www.mctd.ac.uk/zine-commoning-an-alternative-governance-paradigm-for-our-digital-futures/

80 Computer operating systems market share 2012-2023. Statista. **https://www.statista.com/statistics/268237/global-market-share-held-by-operating-systems-since-2009/**

An alternative to GAFAM operating systems, **GNU/ Linux** is an open operating system, with source code accessible to all. In reality, GNU/Linux is much more present than other OSs because, apart from general public usage, this system runs the majority of electronic devices, internet servers, cars and satellites, even our alarm clock radio[81]. Its freeness and security have greatly contributed to its success. The fact that GNU/Linux has a code that is open to all facilitates software audits, and many volunteers constantly participate in its improvement. This system therefore respects privacy because no central company which is likely to collect the data oversees it. Additionally, opening the code makes it easier to detect data collection.

A large community exists that can help with learning how to use it. Unlike Windows or macOS, there are a multitude of versions of GNU/Linux - called distributions - each for different uses. Many distributions are managed by communities or foundations, some by companies. The power of GNU/Linux lies in being able to change distributions at any time. It is therefore rare for a distribution to reproduce the harmful behaviors of Windows or macOS, which would be at the risk of losing its community. As a general rule, GNU/Linux requires less power to operate, which interests us in terms of sobriety, because these distributions are capable of running on old hardware and therefore make it possible to make devices last longer. The trend toward software complexity and its exponential demand for power are more limited in the world of GNU/Linux. Teams have fewer resources to develop complex software and are more focused on a culture of reuse and repair. Another advantage of these free OSs is that they promote a culture of learning and appropriation of digital tools. It's a means of regaining control and creating a digital commons.

A Debian distribution with a modern desktop environment
(source **Wikimedia**, Debian)
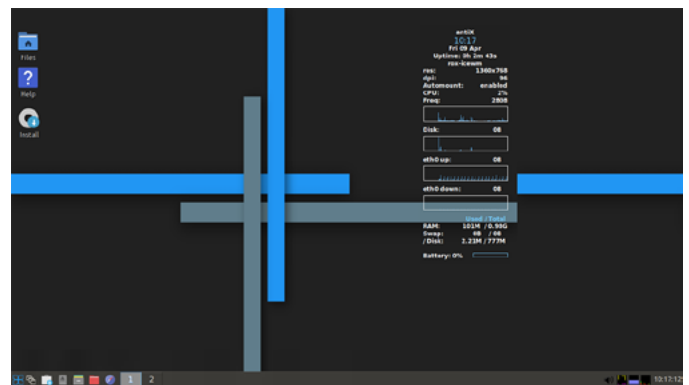
An AntiX light distribution, ideal for old computers
(source **Wikimedia**, AntiX)

The goal of this guide is not to provide a complete introduction to installing GNU/Linux, but we recognise that it is a difficult step. The goal is to encourage you to contact associations and groups that will be able to support you in this transition. Events dedicated to the installation of free OSs, called "install parties", are regularly organised. Volunteers help you install GNU/Linux on your computer. It's a much friendlier way to discover this operating system and learn how to use it in a relaxed manner.

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81   Can the Internet exist without Linux? ZDNET. **https://www.zdnet.com/home-and-office/networking/can-the-internet-exist-without-linux/**

The example of the CEM music school

The CEM (the 'centre for musical expression') in Le Havre is a centre dedicated to popular music that includes a school, a professional training centre, rehearsal studios, a concert hall, a bar and various communal spaces. The association is unusual in having a department dedicated to IT. Nicolas Nouet, its manager, has developed several initiatives to allow the CEM to have more user-friendly digital tools. A batch of reconditioned computers, sometimes improved with spare parts, was acquired and runs on GNU/Linux for the centre's teams and students. This approach, which doesn't fit within the accounting rationale of costs and depreciation, nevertheless represents a significant saving for CEM in the long term, because it allows old devices to last for longer. The association has also developed other approaches linked to free software, in particular setting up a **PeerTube** instance and the development of internal management software, so that they can avoid being dependent on proprietary software that isn't necessarily suited to the centre's needs.

What constraints are there for artists?

We are aware of the limitations of these distributions in a more professional setting. Much of the software that also follows a commercial imperative operates mainly on commercial OSs. However, free projects also seek to offer tools to artists. It all depends on your use of digital technology for the design, production and distribution of music, but this guide includes a section dedicated to the use of GNU/Linux for creating music with free alternatives (see Free Software section for musicians). As there is more and more free software available, there is hope for a solution soon, perhaps even one that you will help to develop. It is always possible to start by transitioning on a personal device to familiarise yourself with the world of GNU/Linux.

Hardware

Extending the life of hardware

Extending the lifespan and usage of electronic devices is the most important step in reducing the impact of digital technology. The constant renewal of electronic devices is in fact the primary source of digital pollution. There are also an increasing number of solutions for combatting software and hardware obsolescence. As with software, these solutions do not come from the main players (manufacturers, mobile operators, public institutions etc.). For example, we have already mentioned the use of GNU/Linux to give new life to old devices and make them last longer. The problem is not only linked to the software, however, hence the importance of repairing, reusing and manufacturing differently.

The second-hand and repair market has been growing significantly over the past few years. There are more and more choices for finding second-hand or repaired devices. Private players like **ifixit** offer repair guides as well as spare parts. Other more associative models are better suited to the creation of commons. **Repair cafés** offer support and guidance for repairing electronic devices in the same way as stand-alone bicycle repair shops. True to the spirit of popular education, these places help us understand and better maintain our devices. They are also places where it is possible to organise collectively against material obsolescence through associations which defend the right to repair, such as **Repair.eu**, or against planned obsolescence with **HOP**.

When it is not possible to repair, buying second hand is a preferable alternative. There are players such as **Smaaart** or **Backmarket** (a marketplace for connecting with resellers), and second-hand sites are an option to consider. /e/ for example offers refurbished smartphones, sold with alternative OS (*Murena*), a version of Android that respects privacy. Rental, a growing model, is also pushing players in the sector to make devices last. Others like Commown offer smartphone and computer rental including a repair service. As a last resort, it is possible to buy new, favoring more ethical products, like **Fairphones** or Why computers. A more ethical phone plan that encourages consuming mobile data sparingly can also be a smart solution to limit the wear and use of our devices. Cooperative companies offer alternative subscriptions that support this approach: **TeleCoop** (France), **Neibo** (Belgium) and **Your Co-op** (United Kingdom).

Instruments, particularly electronic ones, could benefit from the same principles through an expansion of the second-hand and repair market as well as the development of alternatives such as sound **systems that use solar energy**. Recycling is another option worth exploring. These solutions can also have an artistic dimension and lead to the development of new instruments and sound systems.

An autonomous system made from recycled materials

Low Tech Sound is a sound system built solely with salvaged, recycled and found materials. The ingenuity of this system makes it possible to have a sound system based solely on recovered materials, which significantly reduces the ecological impact of the project. The batteries can be charged via solar panels or from the mains. Further technical details can be obtained by contacting Low Tech Sound.

Talking to **Open Mastering**, we were able to learn that the DIY and repair approach can take various forms. The internet allows you to exchange designs and obtain parts that allow you to build equipment at a lower cost. This is the case for a studio microphone similar to a U87 model, for example, that can be built by following online tutorials[82]. The advantages of this approach, in addition to the significant financial saving, are learning and maintainability. Building this type of project requires an understanding of how it works, which subsequently facilitates maintenance and repair of the equipment.

Images : Low Tech Sound

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82   Building a Vintage-style U87 Mic Is Easier and Cheaper Than You Think (Video). (s. d.). DIY Recording Equipment.
https://www.diyrecordingequipment.com/blogs/news/15851880-building-a-vintage-style-u87-mic-is-easier-and-cheaper-than-you-think-video

New technologies

Before discussing the new technologies which have or will have an impact on the music sector in detail, it seems important to us to mention an aspect rarely discussed in technophile circles, that of the ethical issue of technology[83]. New technologies are often presented as neutral even though they carry significant cultural and ideological baggage. Regarding the technologies mentioned below, this baggage is highly evident, with the majority coming from a specific territory: Silicon Valley. These are far from being neutral in their vision of the world and we are already aware of the repercussions, notably in the shape of the GAFAM monopolies[84].

Artificial intelligence (AI)

For the European Parliament, AI represents any tool used by a machine to "reproduce behaviors linked to humans, such as reasoning, planning and creativity[85]". This sector is currently entirely dependent on Silicon Valley players with OpenAI (ChatGPT, DALL·E), a research laboratory and a foundation (supported by Microsoft[86]) and Google (Bard) which is trying to advance at a rapid pace and make up for its late entry into the field[87]. Looking for other AI sectors, we would expect China to be investing but so far there isn't a tool that has dominated the market.

It is interesting to look at whether Europe would be able to offer a more ethical alternative to the current, dominant players. Europe has proven, albeit imperfectly, to be a pioneer in terms of defending privacy with GDPR (**general data protection regulation**). In technological terms, it is regrettable to note that it seems to be too late for a European player in AI to emerge in this race. In

the field of data collection, an essential element for training AI, there are no European internet giants apart from Spotify. European investment in AI remains significantly lower than American and Chinese investment. There are certainly interesting proposals for a more ethical AI in the service of creation and alternatives that avoid the pitfalls of dominant AI[88], but in a globalised free trade market that is tied to a logic of constant monopolies in digital technology, the winner will dictate the rules of the game. When we see the reaction of the founder of OpenAI, who has threatened to leave the European market when Europe talks about regulation[89], it is difficult to imagine a change in the current direction of travel of these technologies.

This situation does not chime with the discourse that claims that AI is a tool that makes everyday life easier, particularly in Europe. We do not have enough perspective yet to understand the risks in many sectors and it does not seem possible

83 Illich, I. (2009). Tools for conviviality. Marion Boyars.

84 Zuboff, S. (2019). The age of surveillance capitalism: the fight for a human future at the new frontier of power (First edition). PublicAffairs.

85 **https://www.europarl.europa.eu/news/en/headlines/society/20200827STO85804/what-is-artificial-intelligence-and-how-is-it-used**

86 *Wiggers, K. (23 January* 2023*). Microsoft invests billions more dollars in OpenAI, extends partnership. TechCrunch.*
    https://techcrunch.com/2023/01/23/microsoft-invests-billions-more-dollars-in-openai-extends-partnership/

87 Vincent, J. (8 février 2023). Google's AI chatbot Bard makes factual error in first demo. The Verge.
    https://www.theverge.com/2023/2/8/23590864/google-ai-chatbot-bard-mistake-error-exoplanet-demo

88 Schlumberger, J.-A. F. (s. d.). Aleph Alpha, LightOn et Bloom, les alternatives européennes à ChatGPT.
    https://la-rem.eu/2023/07/aleph-alpha-lighton-et-bloom-les-alternatives-europeennes-a-chatgpt/

89 Coulter, M., Mukherjee, S. et Mukherjee, S. (26 May 2023). Focus: OpenAI CEO's threat to quit EU draws lawmaker backlash. *Reuters*.
    https://www.reuters.com/technology/openai-ceos-threat-quit-eu-draws-lawmaker-backlash-2023-05-25/

to dictate the rules or control these tools. AI has already been founded on human rights abuses, such as ChatGPT exploiting workers in Kenya for its training and operation[90]. There is little chance, in the view of players in the sector, that the eventual economic model will be respectful of artists and copyright, and in favour of fair remuneration. The first trials are already underway[91]. Currently, the AI offered to us seems to be pointing to ever-greater precariousness for many people. The difference compared to streaming is that this 'Uberisation' will affect many more sectors.

The initial research on AI also demonstrates a significant ecological impact, which could cause digital pollution to explode. The use of AI could also become an accelerator of digital-related problems that have still not been resolved. How can we ensure the veracity of online information and the accuracy of images when AIs are capable of producing large quantities of fake stories and visuals at a speed that humanity has never seen before?[92]

The only conceivable option would be a truly free AI developed within a restrictive legal framework, in order to ensure respect for workers, privacy and copyright, but the market hardly favours ethical criteria. Armed with this observation, we can only recommend very parsimonious use of AI in order to avoid becoming dependent, which is harmful in the long term. The risks of changes in AI's economic model, of pollution, and of non-compliance with copyright are too great to recommend the use of these tools. Using the currently dominant AIs only serves to encourage their development for as long as more ethical alternatives don't exist and Europe doesn't apply stricter regulations.

The metaverse

A concept from science fiction literature, the metaverse is a virtual reality space in which users can interact with a computer-generated environment and with other people. There have been many attempts to create such a world. When I began researching this guide, the metaverse was seen as a project developed by META (Facebook/ WhatsApp). As it stands, there is no need to carry out an in-depth study of the impacts of this concept, as the conclusion is already obvious: the project is a failure[93].

Yet the metaverse provides a very interesting cautionary tale, testifying to the power of marketing and lobbies to launch products for which there isn't a need. When we embarked on the research that we carried out as part of STOMP in January 2023, the metaverse was still shaping up to be a revolution. The European Commission even launched a plan in September 2022 to create a European metaverse[94]. However, the added value for artists seemed to be zero and most companies that had ambitions for launching metaverse projects abandoned ship[95]. At the very least, this episode has underlined the importance of questioning technology and establishing a democratic debate.

90   *Exclusive: The $2 Per Hour Workers Who Made ChatGPT Safer*. (18 janvier 2023). Time. **https://time.com/6247678/openai-chatgpt-kenya-workers/**

91   Vynck, G. D. (20 septembre 2023). 'Game of Thrones' author and others accuse ChatGPT maker of 'theft' in lawsuit. *Washington Post*. **https://www.washingtonpost.com/technology/2023/09/20/openai-lawsuit-martin-picoult-franzen/**

92   Hu, A. (6 juillet 2023). *The overlooked climate consequences of AI*. Grist. **https://grist.org/technology/the-overlooked-climate-consequences-of-ai/**

93   Wagner, K. (3 juillet 2023). Lessons From the Catastrophic Failure of the Metaverse. **https://www.thenation.com/article/culture/metaverse-zuckerberg-pr-hype/**

94   **https://ec.europa.eu/commission/presscorner/detail/fr/STATEMENT_22_5525**

95   Capoot, A. (28 mars 2023). *Disney cuts metaverse division under Iger's restructuring*. CNBC. **https://www.cnbc.com/2023/03/28/disney-reportedly-cuts-metaverse-division-under-igers-restructuring.html**

NFTs

An NFT (non-fungible token) is a non-fungible token (i.e. one which cannot be replaced), a kind of digital identifier attached to an asset (a digital file). The objective is to make a virtual object unique and to easily identify the owner of the work. The token is registered in a blockchain* which, in this case, is the equivalent of a decentralised register serving as proof of identification.

While initially responding to an actual need, that of enforcing copyright, NFTs quickly took a different path, illustrating once again the inability of technologies to solve a societal problem. Innovation and social progress do not always go hand in hand. After the explosion of sales and some record prices[96], values have since largely collapsed and the failure seems to have been recognised by the press which itself had sung the praises of this technology (just like those of the metaverse for that matter)[97]. In the end, many NFTs are comparable to Ponzi schemes[98]:

"In this way, NFTs realize an old dream of capitalism: money and capital that can be generated from nothing, and which is therefore without limits. NFTs are basically title deeds stripped of all the bells and whistles. […] NFTs can only associate a name with a file, an image, etc.; under no circumstances can they restrict the use of this digital object by the entire rest of humanity who has access to it. With NFTs: we can now "own" something as private property without having exclusive use of it, or even without having use of it at all."

Gee, Pourquoi tant de nft ?
https://grisebouille.net/pourquoi-tant-de-nft/

These new technologies primarily benefit already established artists[99]. NFTs have widened the pay gap, just as we have seen with streaming. Like any complex technology, NFTs have a significant environmental cost[100]. This ecological cost is difficult to justify given the economic failure of NFTs.

96   Kastrenakes, J. (11 March 2021). *Beeple sold an NFT for $69 million*. The Verge.
    https://www.theverge.com/2021/3/11/22325054/beeple-christies-nft-sale-cost-everydays-69-million
97   Strzelecki, R. *Council Post: How The Metaverse Can Radically Change Our Lives*. Forbes.
    https://www.forbes.com/sites/forbestechcouncil/2023/02/27/how-the-metaverse-can-radically-change-our-lives/
98   Escalante-de Mattei, S. (25 October 2022). Bloomberg's Massive Crypto Article Derides NFTs as Nothing More Than a Ponzi Scheme. *ARTnews.com*.
    https://www.artnews.com/art-news/news/bloomberg-crypto-nfts-matt-levine-1234644343/
99   Parker, K. (19 April 2021). Most artists are not making money off NFTs and here are some graphs to prove it. *Medium*.
    https://thatkimparker.medium.com/most-artists-are-not-making-money-off-nfts-and-here-are-some-graphs-to-prove-it-c65718d4a1b8
100 Howson, P. (1 April 2021). *NFTs: why digital art has such a massive carbon footprint*. The Conversation.
    http://theconversation.com/nfts-why-digital-art-has-such-a-massive-carbon-footprint-158077

Do other models exist?

NFTs seek to resolve a problem relating to copyright, a subject historically managed by copyright management companies. The copyright model has until now always favoured a minority of artists, who pocket the majority of the income. Streaming platforms and NFTs are currently following this same logic. The idea of free distribution aims to allow artists to regain control over their works by limiting the degree to which they are 'taxed'. Concerts are the primary source of income for most artists. Donations or 'pay what you want' pricing are interesting options for small artists, and don't necessarily generate less profit than the paltry gains from copyright and streaming. In addition to the legal and financial aspects, the idea is to allow the free-flowing dissemination of culture, knowledge and intangible heritage[101]. This is the same rationale as that which applies to free software and the creation of a cultural commons, as Doctor of Science and Technology Antoine Moreau has argued in his thesis 'Le copyleft appliqué à la création hors logiciel' ('Copyleft applied to creative acts that don't employ software').

101 Doctorow, C. (20 December 2022). 2023's public domain is a banger. *Medium*. **https://doctorow.medium.com/2023s-public-domain-is-a-banger-7db8919cbaed**

Essay 3

World-building: how musicians can pivot their digital strategy in response to the climate crisis

by Bas Grasmayer

After two years of pandemic-driven narrative, the public's attention has once again shifted to humanity's most enduring challenge: the environment and the climate crisis. In years to come, everyone will have to deal with both the response and lack thereof from our governments and societies. This will have a significant impact on music in the physical realm and will also affect the digital realm, as artists adapt to new challenges and look for answers to the question: how can I develop digital strategies for a more sustainable music career?

New models

For many artists, the industry has reached the end of the road. **Touring is becoming too expensive. Streaming royalties are not a feasible way to make a living. Success models that are based on 20th century paradigms are crumbling or primarily benefiting just a small percentage of musicians.**

Inflation, high energy prices, floods, droughts, supply chain disruptions – and everything else that makes the daily news feel downright dystopian – are all circumstances that have set us on a trajectory that will divorce us from what once was normal.

To use a trope from the Covid-19 peak days: we are figuring out a new normal. It would not be outlandish to suggest that travel will become pricier. There are subsidies for fossil fuel production, but also for air travel. Consider for example the lack of VAT on plane tickets or the tax exemptions[102] on fuel in Europe. This is not sustainable, in all senses of the word. Eventually, governments must act. Which means that live music, for many artists, may become even harder to depend upon to sustain their careers.

But, if you wanted doom, you could just open a news website, so let's get proactive and focus on what artists *can* do to react to the climate crisis *and* create a more sustainable world.

We need to look out for new models.

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102   **https://www.transportenvironment.org/challenges/planes/subsidies-in-aviation/**

Digital strategy in the age of climate crisis

Good news first: a lot of the basic principles of digital strategy remain the same, even with new models. These basic principles are based on smart use of the technologies we have at hand, psychology, as well as understanding network effects. In short, it boils down to understanding your audience well and then developing business models that cater specifically to their unique needs, wants, hopes, and dreams.

We'll consider the practice of *world-building* as we explore two examples of artists using innovative digital means to bring their fans on their journeys. We'll then look into these technologies more broadly to understand how you might be able to use them at a much earlier stage in your career.

Example 1: BLOND:ISH

As founder of the **Bye Bye Plastic** foundation, Canadian producer / DJ **BLOND:ISH** is well-known for her work in sustainability. Recently, she produced bacteria-based, biodegradable 'vinyl'[103] that come with an NFT. Although the vinyl may degrade over time, the NFTs are intended to be a more permanent[104] record of the err.. record.

Hold up… An NFT? Don't those cost enormous amounts of energy? Well, some of the world's most popular NFTs have been created on a blockchain* called Ethereum, which until 2022 was quite energy-intensive. However, since introducing a new mechanism to validate transactions on its network, energy use has been reduced by 99.9%[105]. This means that the entire blockchain is using just a fraction of the energy a popular website like Airbnb consumes, with NFTs representing just a tiny fraction of all activity on Ethereum.

With that cleared up, let's talk about world-building and how this record fits into the narrative BLOND:ISH is creating for her fans.

World-building is a practice which allows artists to create a universe beyond their individual artist persona through storytelling. Examples of this range from an evolution of visuals used throughout music releases and live shows, different artist personas, introducing new characters or personas, to much bigger metaverse-like experiences. Examples of great world-building artists include **Grimes**, **Sevdaliza**, and **Janelle Monáe**.

BLOND:ISH' vision is 'Happy Happy World' and is described as[106]:

"a parallel reality where systems are whole and unbroken, and people live in abundance and happiness. It is a place where all the aspects of the current system that limit human potential and possibilities are improved and solved."

To access that world and unlock things in that world, fans need a currency called the $ISH token, which BLOND:ISH made with a startup called p00ls[107]. This currency can be earned as rewards by completing certain tasks on p00ls, but is also included when you purchase her (not-)vinyl, for example. In this case, BLOND:ISH' world is currently composed of her website and Discord where these tokens can be used.

It's through world-building that an artist can reach fans around the world and inspire them to envision something better. The artist can then implore fans to start acting towards this vision. In the case of BLOND:ISH, she can even use $ISH token to reward fans for this.

103   **https://edm.com/news/blond-ish-sustainable-biodegradable-vinyl**
104   **https://nftplazas.com/blondish-vinyl-music/**
105   **https://ethereum.org/en/energy-consumption/**
106   **https://www.p00ls.io/whitepaper/ish**
107   **https://www.p00ls.io/**

But that's not the only token BLOND:ISH is involved in. Through her foundation Bye Bye Plastic, people can earn the **$BYEBYE** token as a reward for 'eco-actions'.
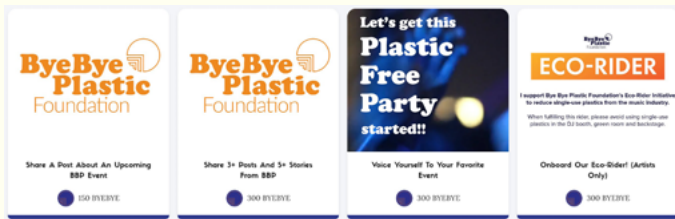
Some of the actions which are rewarded with $BYEBYE tokens.

Example 2: Billie Eilish

BLOND:ISH is not the only artist whose name ends with 'ish' and is well-known for her sustainability work. When asked to name an artist who values sustainability highly, many will undoubtedly answer **Billie Eilish**.

Her 'Happier Than Ever' world tour was a textbook example of world-building. The numerous ways in which she inspired her fans to act more sustainably included: avoiding 117,000+ single-use plastic bottles through reusables and free water refill stations, registering thousands of voters, serving plant-based meals in all tour venues, selling upcycled merchandise, the list goes on[108].

To achieve this, Eilish collaborated with **REVERB**, a non-profit dedicated to making the music business more sustainable. At her shows, REVERB set up Eco-Villages.

This is where things turn digital.

In these Eco-Villages, fans were asked to sign up to REVERB's **Music Climate Revolution**, which regularly informs fans of actions they can take towards a more sustainable world and mobilises them. This pools together the fanbases of artists that value sustainability, so not everything depends on fans' favourite artist to keep the momentum going. Instead, the program forms a broad coalition of music fans who want a world with more sustainable practices tomorrow than there were yesterday.

Additionally, fans could take a digital pledge to eat one plant-based meal per day for a month. This was done in partnership with **Support + Feed**, an NGO set up by Maggie Baird, Eilish's mother, which approaches climate action pragmatically by changing the way people eat.

It can often be challenging for artists to figure out what they can do beyond the basics of greening merch, using eco riders, and otherwise lowering their carbon output. But **where artists can have an outsized impact is through the influence they have on fans.**

Takeaways

Let's wind things back a little: what does the future look like for artists who are just getting started today? What are the takeaways from the above examples that can be applied immediately?

1. **World-building as a paradigm:** Before we got into the examples, we established that both streaming royalties and touring are increasingly challenging means for artists to depend on for career sustainability. By expanding the artist narrative beyond the usual places

where people interact with you, through streaming or a live show, artists can create additional experiences and offerings for fans. In an age of uncertainty, this is not a luxury, but something crucial. It creates a new paradigm which allows artists to experiment with new tools, technologies, and pivot away from things that don't work for them (such as prohibitively expensive touring, or practices that are not environmentally friendly, like lots of merch options).

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108   **https://reverb.org/impact_report/happier-than-ever-world-tour-impact-report/**

2. World-building as activism: One way to have a positive impact on the climate is to start with your own actions, but artists are in the unique position that they can have an outsized impact by involving their audiences. Through world-building people can be motivated to act, to do more, to spur on others to do so too. Few of us will ever be able to put together as big a production as Eilish, but as BLOND:ISH has shown, worlds don't need to be built offline. One can invite people into virtual spaces and online narratives, where they're encouraged to dream, connect, and act. This doesn't have to be a 3D environment; it can be as simple as a group chat that is in line with your artistic intent.

3. Community as a cornerstone: More than ever, building communities around your music is crucial. When you build narratives as an artist, and shape worlds, you need people to inhabit these worlds so that they don't feel static nor stale. By seeing your audience interact with each other, as a community, you can get a much more profound understanding of who they are and what excites them. This way, you can identify new, sustainable opportunities that go beyond the beaten paths.

A necessary ingredient for artists' careers has long been scale. This is especially true in the age of streaming because it takes millions of monthly streams to be able to make a living. Other models require scale, too: to tour, you require fans. To break even on merch production, let alone profit, you need orders.

With these models of scale becoming less effective, how can artists use new technologies to achieve sustainable outcomes for both their careers and the environment?

Virtualisation

A major part of touring-related greenhouse gas emissions is actually audience travel. Could world-building open up ways to create travel-free strategies for artists?

During the Covid-19 pandemic, we already saw a rise of livestreams and other digital content that artists would try to monetise. Producers like Stranjah, who runs a **production education channel** on YouTube, provide excellent examples of ways to diversify revenue streams and reach scale in new ways. Not all followers may be fans of his music, but they do help him sustain his music career.

As we slowly emerged from those restrictive years, new concepts and tech presented themselves, with artists eager to continue the experimentation done during times of crisis. Concepts like metaverses, blockchains, and artificial intelligence entered the day-to-day of the music business.

It's important not to look at these technologies in isolation. Instead, we should consider them ingredients of an emerging landscape. Likewise, we should not separate this from the current digital landscape, not the context of our time and, in particular, the climate crisis.

One way in which artists can find scale in the future is through virtualising themselves into avatars. Hatsune Miku is an avatar artist that has been around for over a decade and in 2014 even opened a concert for Lady Gaga. More recently, artists like **Holly Herndon** and Grimes have created AI models trained on their vocals and have given people the right to create music with their voices. The latter even lets people distribute their creations and monetise them with a 50/50 royalty split[109]. This implies two things:

1. It involves fans in artists' worlds, allowing them to become part of the world-building process.

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109   **https://www.bloomberg.com/news/newsletters/2023-08-03/ai-generated-grimes-songs-struggle-to-climb-the-music-industry-charts**

2. It scales an artist's capacity. In this case, hundreds of thousands of people can collaborate with these artists, without actually needing either artist to be in the room for it, or even be aware that it's happening.

With generative AI tools becoming easier to use, even inexperienced people will be able to express themselves musically. There will be a higher expectation of interactivity from music, as well as a feeling of personalisation. The good news is that as an artist, it will also become easier to invite fans to play with you. Who knows, you might be able to spawn versions of yourself110, or your world, that each fan will have a totally unique & personal experience with. This could be coupled with a revenue model that allows you to connect in perceived real time with fans worldwide, without anyone needing to travel for it. Another way to achieve scale, is to band up with others and form a strong scene. Together, you are louder. Blockchain technologies allow communities to issue their own currencies, such as the $ISH and $BYEBYE tokens mentioned earlier. In BLOND:ISH's examples, those tokens are used to unlock offerings by BLOND:ISH and Bye Bye Plastic themselves, but one could also imagine these tokens being used for more bottom-up approaches. For example, a scene might decide to funnel their collective revenue into a

pool and then vote on spending from that pool. Voting could be weighted by how many tokens individuals in the community have earned. Artist-led music curation communities like **The Park**, **heds** and **Songcamp** are great early examples of this.

We are entering an age of resilience. As an artist, you can provide narratives that unite strangers and make them feel seen, or heard. You can invite them to participate, which has become easier than ever thanks to AI. Communities can be shaped that can actively pool resources to extend these worlds and then vote on how exactly to do that. This community-resilience has been made easier than ever due to blockchain technology, reducing the dependency on more formalised institutions like the banks whose investments have contributed to the climate crisis we find ourselves in today.

You can do all this while progressively cutting your own environmental impact, by reducing unsustainable merch and travel practices. There will be no shortage of doom- scrolling, so provide fans with a better vision, something to believe in, and something to act upon.

Be imaginative. Build worlds.

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110 **https://www.musicxtechxfuture.com/2020/12/15/your-own-personal-ai-music-star/**

Perspectives on new technologies

It is essential to question technological advances and not succumb to the fear of missing out on an innovation (the FOMO effect). It is unrealistic to hope that future technological progress will resolve societal (such as equality, exclusion, wages) or ecological issues. Recent innovations present serious risks without offering tangible benefits for artists. In reality, some failures can be beneficial. Furthermore, these advances tend to neglect the issue of climate change. This is perhaps where institutions and the media should focus their efforts.

It is difficult for us to blindly embrace this technological buzz if it comes without the promise of more ethical and caring services for artists. We are more interested in exploring human-centered collaborative models, while awaiting the emergence of free and ethical solutions. We believe that a budgetary allocation for the protection of artists, providing fair remuneration in a more digitally sober context, would be a more adequate response to the needs of the cultural sector than the simple adoption of new technologies that lead to an increase in energy consumption and the use of electronic devices.

Free software for musicians

We've talked a lot about software for everyday use, but we haven't looked at software that is specific to the music sector. To have more freedom for creation, and in particular to direct software towards greater digital sobriety, the free software model could be a solution given the lack of interest in the development of less energy-consuming solutions by companies in the sector. Music software follows the same patterns as other sectors. The economic model is based on license renewal or a subscription model which pushes software creators to offer innovations that are not necessarily useful to most people. It's more about creating incompatibilities between versions to force license renewals. Working via the cloud, which is increasingly widespread in commercial software, does not seem to allow for greater digital sobriety. In addition, there is the problem of data collection, which is central to this type of system.

Rather than creating dependence on companies, we wanted to explore more collaborative ways of producing through the use of free software. These solutions still remain marginal, although some are already popular with enthusiasts.

We want to create a space for discussion around this opportunity and establish links between free software developers and artists.

Often, due to lack of resources or the fact that there is a multitude of specific tools, free software is less complex than its commercial equivalents. But free software makes it possible to work on older computers. Open file formats run contrary to the proprietary software model and avoid the need for constant updates and license renewals. Some of this software works on all operating systems (Windows, macOS, GNU/Linux) which can allow you to test them before switching to GNU/Linux. As we

mentioned in the operating system section, a switch to GNU/Linux increases the lifespan of devices, and this less resource-intensive OS offers a more economical solution.

Among the various versions (aka distributions) of GNU/Linux that we've already mentioned, there are two that are specific to artists: **Ubuntu Studio** and **Librazik**. These distributions come pre-installed with many programs that are dedicated to music and multimedia creation. This is a good opportunity to discover the many possibilities of free software for artists, especially since it is entirely possible to test them on an old computer as a way of getting used to this software. In informal interviews we conducted, the primary reason given for moving to free software was the philosophy behind the free software movement, followed by the fact that it was free. Sustainability was another positive reason that was mentioned.

One of the specific attractions often mentioned by artists using free software is the diversity of choice. There is a great variety of software that performs specific functions. This trend avoids unnecessarily complex software that requires significant resources. In the free world, simple and specific programmes fulfil complementary functions, avoiding the need for powerful (and therefore new)

machines. This also limits the time it takes to learn complex new software, particularly when you have been dependent on proprietary software, which tends to lock us into creative routines. Of course, there is also versatile free software like **Audacity**/**Tenacity** (audio editor) or digital audio workstations like **Ardour**, **LMMS** and **Zrythm**. These programmes offer a variety of options but take longer to learn. This is the case with any software, free or not. The diversity and ease of testing a multitude of programmes on GNU/Linux should spark the interest of many artists.

Selected software:

- **Qtractor**: audio editor
- **Rosegarden**: midi and score writing
- **Jackd** or **PipeWire**: audio server
- **RaySession**: session manager
- **Non-mixer**: audio mixer
- **MuseScore**: score editor
- **Sooperlooper**: looper
- **Audacium**: audio editor
- **Audacium**: guitar amp
- **Mixxx**: DJ software
- **Lilypond**: musical engraving
- **Open Sound Control AMMD**: OSC controller
- **Calf Studio**, **LSP**: plugins
- **VCVRack**, **Cardinal**, **Vital**, **SurgeXT**, **Bespoke Synth**: modular synthesizer
- **Norns shield**, **Zynthian**: project with Raspberry Pi (microcomputer)
- **TidalCycles**: musical compositions using live coding

This is not an exhaustive list. There are communities and websites that can respond to these needs, provide help with learning and answer questions. For this we can recommend **LinuxMAO** and its forum, English-language **forums**, the **Dogmazic** community, guides such as the **Floss Manuals**, **wikis**, **web feeds** and even a school like **Activdesign**. Other sites list free software for music,

such as Libre Audio Visual or Linux Daw. The digital recording studio at **Jardin Moderne** in Rennes is equipped entirely with free software, which is ideal for learning by doing.

The transition can present challenges. Getting started may take time depending on your habits. Compatibility issues with hardware may arise, so it is good to inquire and test. It is entirely possible to start with a sound card for around a hundred euros and free software on GNU/Linux. In the long run, this can be economical (no licensing costs and greater durability of hardware). Adopting free software is about building commons for all, improving software over time and making it sustainable at a lower cost. It is an ethical approach[111]. However, it is advisable to support the communities that develop this software, whether by participating in development, promotion, education or through donations. If a free tool that suits your needs does not yet exist, perhaps it will be developed in the future, or your feedback on existing software could help.

And in other sectors?

In graphic design, illustration, animation and video games, the use of free software is increasingly widespread. The fact that users can participate in the development of software has made it possible to better adapt it to specific needs, to avoid functionalities that may be unnecessary or even harmful for users (data collection, use of DRM, change in pricing policy). Blender, for example, is 3D animation software that is increasingly being used by professionals, including by major studios such as for the film Wolfwalkers[112] produced by Cartoon Saloon.

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111 La bataille du Libre // Hacking for the Commons, **https://www.labatailledulibre.org/le-film/** Accessed 6 Oct. 2023

112 Blender, "2D Isn't Dead, It Just Became Something Different": Using Blender For Wolfwalkers, **https://www.blender.org/user-stories/2d-isnt-dead-it-just-became-something-different-using-blender-for-wolfwalkers/**

How to develop free software in the music sector

Free software and licenses are also part of a different approach to sharing and payments. We can see this with netlabels that distribute music freely and offer bulk orders. They are often more militant than their more traditional equivalents. The studios and their artists could also be vectors for the creation of digital commons aimed at the music sector. Examples exist, such as the **cooperative of free artists AMMD** who make music using free hardware and software. The creation of commons seems necessary as a means of opposing monopolies, which, in digital technology, always seem to be established to the detriment of users[113]. Regaining control of tools and distribution is essential if artists want to regain their creative freedom. Today, many educational establishments, including those in the public education system, favour proprietary software, which encourages their distribution and adoption. Education should be an area that is free from commercial constraints, providing training based on sustainable and user-friendly tools. Media libraries could also play a major role in promoting free software and music, in line with their mission of providing access to culture. The **Ziklibrenbib** project has adopted this approach. Ideally, these actors should adopt ethical values aligned with this approach to production and distribution, guaranteeing a fair distribution of income, while using resources in a reasoned manner.

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113 Doctorow, C. (13 August 2023). Enshitternet. Medium. **https://doctorow.medium.com/enshitternet-c1d4252e5c6b**

Payments, streaming platforms and ticketing

Direct payments that cut out some of the middle men, free participation and donations seem to be much simpler payment models to implement, technically and in human terms. These systems have the advantage of being more digitally sober, because they are less complex compared to new technologies like NFTs[114]. In addition, sobriety requires that we consume energy for useful purposes and NFTs do not appear to fall into this category.

Streaming platforms are increasingly used as social networks. Their economic models also seek to create monopolies that do not allow for a fair distribution of income[115]. The platforms conform to the model of the attention economy, to the detriment of energy sobriety. As with all commercial projects, the community (artists and users) lacks control over the tools. Payment systems are naturally the primary concern for these platforms. The race to increase market share comes at the expense of paying artists. These platforms have the same privacy problem as mainstream social networks. Spotify and YouTube have already been criticised for failures to comply with the GDPR (general regulation for the protection of private life)[116]. The model of streaming platforms favours artists that are already well-known and supported by the majors, and does nothing to upset the existing model of music distribution and payments. There also remains the risk of takeover which will probably be the end goal for the streaming market. Apple (with Apple Music) and Google/Alphabet (with YouTube Music) have significantly greater

financial resources than companies focused on music streaming. The risk of a buyout is therefore very significant. This phenomenon has already been observed with social networks: Facebook bought Instagram then WhatsApp, establishing a monopoly over our daily communication in the West.

There are noticeable effects on music, such as a reduction in song durations and a standardisation of musical styles. Just as with social networks, an alternative offering more control to users would guarantee better management of distribution and income for artists. The Fediverse offers alternatives Funkwhale and PeerTube (for videos), but the two solutions remain very marginal. They have the merit of existing and of avoiding some of the harmful effects of commercial solutions. Some larger players, like Bandcamp, offer a fairer model, but the very structure of the company does not guarantee the sustainability of the model. Recently, changes in the organisation of staff have demonstrated its fragility[117].

114   Howson, P. (1 April 2021). *NFTs: why digital art has such a massive carbon footprint*. The Conversation.
     http://theconversation.com/nfts-why-digital-art-has-such-a-massive-carbon-footprint-158077

115   Sisario, B. (7 May 2021). Musicians Say Streaming Doesn't Pay. Can the Industry Change? *The New York Times*.
     https://www.nytimes.com/2021/05/07/arts/music/streaming-music-payments.html

116   Lomas, N. (13 June 2023). Spotify fined in Sweden over GDPR data access complaint. *TechCrunch*. **https://techcrunch.com/2023/06/13/spotify-gdpr-data-access-fine/**

117   Silberling, A. (16 mars 2023). Employees at Epic-owned Bandcamp form union. *TechCrunch*.
     https://techcrunch.com/2023/03/16/employees-at-epic-owned-bandcamp-form-union/

When it comes to ticket sales, a platform like Ticketmaster has become indefensible because of its model which is detrimental to the entertainment world and for fans[118]. Although there are alternative self-hosted tools for selling tickets, they are technically more difficult to set up. Of course, associations and services are there to make the task easier, but they do not enjoy the notoriety of Ticketmaster, making the lack of a mass reach a major obstacle.

Faced with this lack of alternatives and control, it is important for artists to support free options to ensure a future where they will have more control, especially when their income is at stake. They can very well combine a commercial service and a free service, gradually promoting the growth of the second. These alternatives, often financed by donations, are interconnected, offering strong potential for interoperability.

Pooling is also an avenue to explore. Artists can pool their resources, forming collectives to, for example, manage a PeerTube instance, thereby reducing costs. Cooperation between artists and digital players is possible, with studios as potential instigators. Several models based on artist residencies, associations or cooperatives can be adapted to help to liberate the sector. We believe that sharing a web space could increase the freedom of artists. As it is, associations like the **GAM** exist, but they do not provide tools to create commons.

Along the same lines, sales could be conducted using tools developed collectively to maintain control and strengthen the power of communication. Alternative payment models, such as free pricing or donations, could supplement income. The majority of artists' income is derived from concerts. It is therefore essential for them to become better known, without the barriers of platforms or costs. Free software and licenses appear to be ideal solutions. Ultimately, creating commons is more realistic than challenging dominant players, and it could make the industry more energy efficient.

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118 Tickets: Last Week Tonight with John Oliver (HBO). (s. d.). **https://www.youtube.com/watch?v=-_Y7uqqEFnY**

Conclusion

We are at a pivotal moment for the music sector and for culture in general. Digital players risk monopolising creativity and distribution tools, establishing monopolies that are increasingly difficult to dismantle. Digitalisation has already disrupted the cultural sector, changing the means of remuneration and distribution. With the emergence of technologies like AI, new upheaval is looming. It is therefore urgent for the sector to regain control of its creative tools to guarantee its artistic freedom and financial autonomy. In addition, this would make it possible to develop more sober digital tools. As it is, new technologies are currently evolving in a context of free trade and endless growth, a trajectory which is incompatible with the sobriety necessary to face the socio-environmental crisis.

Although this guide presents many technological solutions, a number of them are individual initiatives. This is why we focus on partners who are capable of helping you take further steps. The idea is to promote synergies, because individual change, although relevant, often faces technical obstacles and its impact is limited. More than anything, we recognise the need for collective transformation. A collaboration between artists and industry players in a more humane digital world would be much more impactful. It is essential to build together to achieve ethical digital technology. We cannot count on the transformation of traditional companies, whose actions have shown that transition is not their priority. Their approach, even if it is "green" on the surface, remains insufficient as a response to current socio-environmental challenges.

Controlling our production and communication tools would also strengthen our political weight, allowing regulation that is more favorable to artists and users, far from the influence of lobbies. The only effective approach is collective - individual actions will not be enough. The main thing is to collaborate with players engaging with sober, ethical and user-friendly digital technology; this is the main lesson of this guide. Artists can strengthen these initiatives, and these collectives can help artists navigate the digital world. This guide is above all a plea for collaboration aimed at regaining control of our digital environment.

Part 3

Looking Forward

Beyond taking note of and exposing the current risks, we also wish, with the STOMP project, to question the current architecture of digital innovation, in order to advocate in favor of fair, sustainable and ethical practices and usage, taking into account long-term environmental and societal impacts.
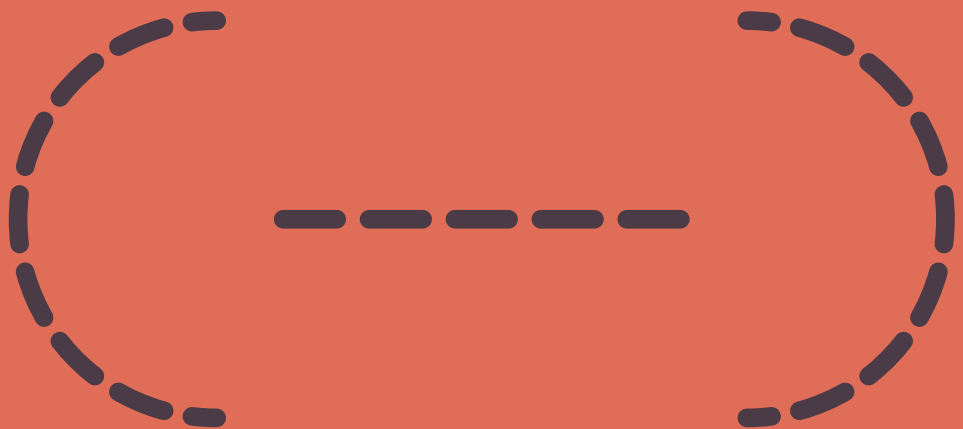
Essay 4

Where are we now?

by Bela Loto Hiffler

The environmental impacts of digital technology are increasingly attracting the interest of citizens, the press, public authorities, local authorities and businesses. The subject is gaining real traction. However, this keen interest hides many blind spots. Among them are disastrous health and psycho-social effects and human rights violations. Attracting little attention, they are definitely no match for digital fever.

Furthermore, and let's not be dupes, 'responsible digital' has become a sometimes very attractive business opportunity. The merchants have definitely returned to the temple. Responsible digital technology has become part of green currency, contributing to the growth of all sectors of our economy.

But let's go back to what we would like it to be. A more responsible digital approach should not be limited to reducing 'negative externalities'. Everything we think of as 'problems' are only symptoms and it is futile to try to relieve them if we do not attack the root of the evil that is gnawing at us. Unfortunately, the systemic dimension is generally not understood, and we continue to miss the fundamental issues.

It is not surprising therefore that, with a few exceptions, only the indicator relating to the 'climate', expressed in terms of greenhouse gas emissions, is highlighted. However, this prevents any proper understanding of the subject. To grasp the environmental issue, it is in fact fundamental to consider the complete life cycle and take all the indicators into account: depletion of abiotic resources (non-renewable minerals and metals, fossils), climate disruption, primary energy, acidification of the air, fine particle emissions, ionising radiation, depletion of water resources, human toxicity, aquatic ecotoxicity, etc.

A virtuous approach should also anticipate the direct and indirect rebound effects* that are like so many traps that close around our feet. Furthermore, there is an urgent need to integrate social and human indicators into any analysis and to thoroughly review the untenable relationship we have with electronics. Green IT, a formidable oxymoron, is absent while *Red IT*[119] reigns supreme: violent, colonialist, bloody, deadly. Furthermore, is it not remarkable and particularly worrying that social networks are not listed by the WHO as sources of addictive behavior? The only ones mentioned are addictions to video games and gambling.

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119 An expression I now use every time I speak in public, inspired by reading *Cobalt Red*, Siddharth Kara, St. Martin's press, 2023

To date, numerous life cycle analyses have helped to clarify the landscape and identified the major trends. Little by little, sectoral questions emerged, particularly within music and digital audio. Studies have made it possible to obtain decisive information but we have encountered numerous uncertainties. As Vincent Lostanlen indicates[120], "For the most part, the ecological accounting of music still has to be invented."

Let us emphasise the evident truth: there are no digital services without terminals or heavy infrastructure. Materiality is at the center of the ecological question.

The sustainability of the digital audio sector is very fragile when we consider streaming, which represents the bulk of music distribution, and which drives consumption: services themselves, acquisition of terminals and equipment that goes with them such as earphones, headsets, speakers, etc. Remember that the majority of environmental impacts (2/3 to 3/4) take place during the extraction and manufacturing stages. In short, to listen, you need some serious hardware. Serious hardware that rapidly becomes obsolete. Consumerism is here, more than ever, at the heart of the matter.

Weak signals?

I propose here to take three examples – the first of which is historical, the following two more recent – which seem to me to be the reflection of artistic impoverishment and the sign of great restiveness in our society: MP3 compression, sped up music and artificial intelligence.

The MP3 audio compression standard

At the very beginning of the 2000s, the MP3 (acronym for MPEG audio layer 3) audio standard, entailing compression with data loss (or destructive, lossy), was adopted. By studying the issue over 20 years ago, I was able to share with my readers[121] the fact that with this compression, a large part of the signal was lost: the lowest and highest frequencies were literally sacrificed. By keeping only the signal likely to be perceived by the listener, the smoothing carried out erases all the dynamics (which has also pushed users to increase the volume to compensate, which is not without physiological consequences). Of course, there are several MP3 compression rates ranging from 96 to 320 kbps[122] but the majority of us have used 128 kbps (most of the time without knowing it) where the sound is seriously degraded. By comparison, 128 kbps MP3 is 1/10 the signal of a CD (1411 kbps).

At the time, this pill was undoubtedly difficult to swallow for the demanding musician, the informed music-lover and any self-respecting sound engineer. Personally, I really had the feeling of witnessing a step backwards and I would even go so far as to speak of audio trauma in the early days. Without going further into more technical considerations, this techno-economic choice was very clear: quantity was preferred to the detriment of quality. By minimising the weight of the data, the goal was obviously not to be ecologically economical but to encourage massive consumption of musical data. It was a decisive victory for cultural capitalism.

Sped Up Music

Sped up music consists of listening to music in an accelerated version by increasing the tempo. This technique originated on TikTok, the Chinese network dedicated to sharing very short videos.

If you speed up the tempo, the frequency changes. We therefore obtain higher-pitched voices. Unless we use a process, time stretching, which allows the frequency to be preserved. Voices don't respond well to crude manipulation. Accelerated voices are comparable to

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120 Contribution from the collective work *Musique et données*, CNM Editions, 2023
121 *Le son sur le web,* Bela Loto, Editions Dunod, 2002
122 Abbreviation for Kilobits Per Second, a measure of data transfer speed

those affected by helium, losing their uniqueness. In this example, not only are listeners manipulating and distorting the work, but they are attacking the integrity of the artist as a person by degrading their voice. We must be in no doubt, a performer can easily choose to play a musical work more slowly or quickly. Playing with the tempo as part of an interpretation is indeed an eminently artistic choice and there are numerous examples in very varied repertoires. And this has always been the case. But manipulating a finished work and distributing it is something else entirely. This is a clear infringement of rights (of the writer or producer) unless authorisation has been expressly obtained. It's clear that new legislation is urgently needed.

Conversely, to meet fan demand, some artists have released accelerated versions of their songs aka how to breathe new commercial life into a product. This is the case, among others, of the track Me Gustas Tu by Manu Chao, where the sped-up version was released by the label.

From a physiological point of view, acceleration stimulates the brain and causes a certain euphoria, and it adds to the dopamine generated by a song when we like it (causing frenzy, and a psychedelic effect). But this repeated over-stimulation can lead to a shortened attention span and difficulty concentrating.

The remixes back in the day seemed more creative to me (some of them anyway) because they played with various qualities in a track via the mixing process. Sped up versions, by definition, only play with speed. Exit slowness, exit silence. And yet the latter is, paradoxically, a part of music. You have to know how to 'play' it.

In conclusion, accelerated music is the symptom of a bulimic society in which no-one has any time. This is a perfect illustration of general acceleration (brilliantly

elaborated on by Hartmut Rosa[123]). This trend of consuming content more quickly (speed listening and speed watching) makes me think of fast food. A Tricatel generation (I am referring here to the junk food from the film The Wing or the Thigh and not to the label of the same name) raised on TikTok is not a good thing, as far as I'm concerned.

The third and final example is that of artificial intelligence. I played ball and took a close look at certain AI-based audio tools including a de-noiser (noise reduction), de-wind (removal of wind noise), speech enhancement, de-rustle (removal of contact noise, from lapel mics etc.). So far, so good. These treatments are very effective. But be careful, they can be quite extreme and you need to have a very good ear to use them well.

There are other tools available, such as a de-mixer, which is supposed to be able to separate a voice from instrumentation. So far, what I have heard is not convincing. The signal quality is not good.

Last but not least, I tested a few tools using AI to generate pieces of music from textual instructions. I have rarely laughed so much in my life. The results were distressing, genuine gobbledygook with an unstable time signature. Musicians, creators, do your job, you still have space to operate in, but there are snakes in those hills!

In the meantime, I completely agree with what Karl Sharo when he says: "*Humans doing the hard jobs on minimum wage while robots write poetry and paint is not the future I wanted*" which I would happily elaborate on by saying: "*Humans who assemble our smartphones and other digital devices in terrible conditions on indecent salaries while Audiogen, Mubert or MusicGen robots compose music, this is not the future I envisioned.*"

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123 *Rendre le monde indisponible*, Hartmut Rosa, La découverte, 2020
Accélération, une critique sociale du temps, Hartmut Rosa, La découverte, 2010

Ultimately, where do we want to go?

We can always try to reduce our pressure on the environment and reduce negative externalities by extending the lifespan of our machines and adopting better daily practices. But the most important thing is to know where we want to go and what the meaning of it all is. And it is here, whether in the digital audio sector or elsewhere, that the question of growth arises. Believing in infinite growth of capital in a world where resources are limited is collective madness. These are not the most important considerations. The top priority is the one that is being delivered to us morning, noon and night, by always inviting the same decarbonisation experts to speak in the media, as though there are no philosophers or artists interested in life on the planet! This is obviously not the case. These are the philosophers, artists and poets we would like to hear more of.

As Camille Etienne says: *"We cannot let engineers only debate among themselves about how to reduce our greenhouse gas emissions."*[124] And for Aurélien Barrau[125] *"It is urgent to invent another relationship with life, rather than reducing CO_2 emissions from our mobile phones."*

Artists and musicians have a crucial role to play in questioning this world in crisis in their own way. They are not just products to consume. Please, let's not reduce music to just the digital stream. A concert is a unique and magical moment of communion. However, to be ecologically sustainable, the model of the 'spectacle' will have to reinvent itself and radically simplify. This is no longer a time for technological orgies, for 90 semi-trailers[126], for extravagance. Let us remember that the well is not bottomless. The metal resources we need to make our machines are not unlimited, they are even at critical levels for many of them. The future, if we are to be alive to participate in it, will look more like a low-tech landscape. Will the future take place without electricity, as musician Bass Tong hopes for through his techlow music[127]? Will we witness the great return of acoustic music for small audiences?

Let us prefer the living to war machines. It is high time to think seriously about it and take concrete action.

Musicians of all countries, wake up!

Bela Loto Hiffler is president of Point de M.I.R, (*Maison de l'Informatique plus Responsable*) which has been working for many years to raise public awareness about the environmental and human impacts of digital technology. Bela Loto Hiffler is also an associate of M.I.R C & F, where she delivers training (in more responsible digital technology, responsible design of digital services, accessibility and human rights) and provides sessions under the Numérique Responsable banner. A former composer-arranger and sound engineer, she became interested in the web from the point of view of emerging audio technologies (*Le son sur le web*, Dunod, 2002), and she is also the author of the *Guide d'un numérique plus responsable* (Ademe, 2020) – a guide to responsible use of digital technology - and is preparing a new work. Bela Loto Hiffler participates in numerous working groups and makes spirited contributions to conferences, panel discussions and other events. In this way, her intention is to defend a "well-tempered" digital technology - one that is respectful of human rights - and happily describes herself as an "observer of digital inebriation".

124 Pour un soulèvement écologique : Dépasser notre impuissance collective, Camille Etienne, Seuil, 2023
125 **Catastrophe écologique : bilan et perspective. Aurélien Barrau à l'Université de Genève, 2023**
126 Mylene Farmer show, Nevermore 2023, 90 semi-trailers, compared to «only» 70 for Beyoncé
127 With ten PVC pipes and two flip-flops, Bass tong plays acoustic techno on the street

And now, how do we proceed?

As we have seen throughout the pages of this guide, the questioning of current digital uses, in connection with the necessary ecological transition of human systems, affects the music sector in a profound, systemic way. It is a question, at this very nascent stage of the subject in the professional community, and considering that current initiatives are still having far too little impact on market forces, to inspire a wide-ranging conversation about these questions. As Maxime Efoui-Hess and the Shift Project team have declared, "the majority of public opinion and the economic and political classes still believe that digital usage does not need to be subject to the same vigilance as other sectors with regard to their compatibility with energy and climate imperatives. This observation partly explains why few concrete solutions seem to be emerging, and only makes the need to open this conversation up more pressing. This discussion that we are calling for must contribute to producing knowledge and raising awareness throughout the musical ecosystem in a democratic manner.

Through consultation, lively debate and an increase in initiatives and engineering projects, it is time to find solutions, methods and processes to reduce the impact of our digital musical uses. It is essential that the entire music ecosystem addresses these issues in a concerted, democratic manner, and does not leave them in the sole hands of digital service providers, storage and streaming solutions.

The question of digital musical usage is technical, of course, but it is above all the product of economic and political choices that must be confronted, as Vincent Lostanlen reminds us of in the case of streaming, which "presupposes a certain high-tech consumerism, as well as a certain vision of political and urban planning called "productivism" that is already incompatible with the Paris agreements. We subscribe here to the conclusions of the work of greenIT and Négaoctet, the recommendations of the INR specified in its responsible digital charter and those of the Shift Project, which came subsequently, in terms of planning for decarbonisation and reduction of the environmental impacts of the digital system:

"I think in general what the entire music ecosystem needs is education, support and also data. More transparency and more research when it comes to the impact of the general ecosystem. This is not just for artists but for all stakeholders, artists included."

Karla Rogozar, Network Development, Sustainability and Project Coordinator at Impala

« If there is a lot more noise and activity around this area, then perhaps those big companies would feel more like they needed to do something more about it »

Peter Quicke, former co-CEO now Chair of Ninja Tune, co-founder of Music Declares Emergency, co-founder of Climate Action Group, member of Impala's Sustainability Committee

- We need to be able to measure the impact of digital musical activities: without this sincere and transparent measuring work by the actors in the value chain, no democratic decision-making can take place. This is of course work that must be carried out by the main providers and managers of digital traffic, namely the DSPs*, but more generally by all industry players, whether it's record companies, labels, distributors, publishers, but also rights collection and distribution, promotion and marketing companies, and artists of course, as well as unions and professional organisations.

- This work must lead to an optimisation of digital uses and services in the music sector and must make it possible to change the practices of professionals as a whole, artists and the general public included. It is about bringing about a profound transformation of uses and systems, through, among other things, the development of a 'digital low-tech' in opposition to the race for technological innovation that is so widespread, and 'eco-radical design of digital services'. Without this collective reorganisation of uses that DSPs and artists together have the power to make technically possible and socially desirable, decarbonisation and the reduction of the environmental impacts of musical uses cannot occur. Professional organisations will play a determining role in the effective coordination of these discussions.

- As in all other sectors of the economy, the work that needs to be carried out and the effective implementation of the roadmaps require a general increase in the skills of all stakeholders, and the teams they are comprised of, through extensive awareness and training campaigns. With this in mind, artists must be associated with the work through a very particular approach:

"A very artist-centric kind of educational effort where their hand could be held a little bit through the process, I think that's the way to go".

Anna Dungal, Events team for Iceland Airwaves & Sena Live, founder of OK Agency

Here, in the form of summary, we present the few recommendations and proposals that emerged from the months of research carried out for this project:

Actions to be taken at sectoral level

- Engage in broad sectoral consultation and politicise the subject of digital uses in music and the reduction of their impact

- Obtain commitments from Digital Service Providers (DSP) to communicate data on energy consumption and environmental impact of their infrastructures.

- Encourage Digital Service Providers (DSPs) to develop more data-saving features

- Launch a feasibility study on sharing the storage of audio files such as masters to limit their proliferation on the servers of all streaming companies.

- Initiate a sectoral communication approach aimed at users in order to move away from the sole artist/fan relationship on these subjects

- Create a rating score for digital services to provide users with a benchmark for the energy saving practices of digital services

Actions to be taken at the level of artists' professional entourages

- Train yourself and conduct your own monitoring to be able to help artists take this subject into consideration in the management of their career, in terms of their choice of equipment and their marketing strategies

- Raise this subject within institutions representing the industry (unions, federations)

- Raise the subject with management of labels, record companies, publishers, distributors, pushing them to engage with current projects

Actions to be taken at the level of musicians and bands

- Contribute to the politicisation of the subject within their professional sphere

- Get involved in ecological transition movements in entertainment to swell their ranks and speak out

- Encourage your audience to download your music rather than stream it.

- Offer more "disconnected" experiences to the public, such as telephone-free concerts

- Buy good quality equipment, take care of it, learn how to repair it

- Use second-hand equipment rather than new, rent when you're not certain of wanting to use it

- Resist Gear Acquisition Syndrome (GAS), a phenomenon that causes a musician to compulsively purchase gear.

By not addressing the subject now, the players in the European music industry are taking a risk: that of letting the market and private, non-European players, mainly from Silicon Valley, deal with the issue according to their own economic and ethical framework, with inevitable consequences. An even greater risk would be to approach these questions with a techno-solutionist approach, like the DIMPACT project in particular, and to think that a simple improvement of formats, systems and methods of energy supply would resolve the problem posed by digital music. This is unfortunately the approach currently adopted by the majority of actors in the industry.

On the occasion of the Grammy Awards and the various events organised by his group around the ceremony, Lucian Grainge, Chairman and CEO of Universal Music Group, presented Bille Eilish with the first Universal Music Group X Reverb Amplifier award[128], given to the artist who has done the most in concrete terms to reduce the impact of their musical activities, particularly through engagement with fans. The major took the opportunity to talk about its various actions: the implementation of 100% vegetarian meals, donations to a charity, and support for a rather confusing initiative: a start-up which deploys a technique for capturing CO2 in the air and returning it to the depths of the Earth. Universal's press release therefore commits to "eliminating 100% of the CO2 generated by the energy consumed by events". The idea would be wonderful, if it weren't cruelly contradicted by reality: we simply do not have enough available soil to consider offsetting current lifestyles by planting trees or burying carbon captured in the air. And that's without mentioning the risks inherent in the use of these unproven technologies for capture and burial, without sufficient hindsight to verify their scientific effectiveness and safety, and which seem to exist largely for the financial benefit of gas and oil companies wishing to continue with business as usual. The example of carbon offsetting should serve as an example here: the comfortable idea that we can compensate nature for the impact of our economic activity merely by planting trees is as beautiful as it is ineffective[129]. The risk, finally, of not tackling the subject would be that others would do it instead of the musical ecosystem. Regulatory bodies, including Arcom for example, are showing positive signs by officially asking streaming platforms to communicate with their subscribers about ways to use their services more responsibly, and to develop functionality with the same aim in mind.

"When you've got governments that have committed to net zero targets, (...) at some point those entities, if they're not seeing the transition they want voluntarily, are going to start legislating to make sure it happens. So as a business, you probably would be well advised to start thinking about when that legislation will come, what it will look like and what it's going to cost you versus the cost of doing the transition before the legislation comes in."

Lewis Jamieson, Director of Communications and Industry Relations for Music Declares Emergency

128 **Universal Music Groupe (2023) : "Universal Music Group expands partnership with reverb during music's biggest weekend to raise the bar for environmental sustainability for music events" 04 février 2023**

129 **Thales A. P. West et al., (2023) Action needed to make carbon offsets from forest conservation work for climate change mitigation. 381,873-877. DOI:10.1126/science.ade3535**

Finally, the public could ultimately reject streaming as Vincent Lostanlen, citing Kyle Devine, explains: "It could be that the social representation of streaming as a source of ecological and social damage affects musical content, and ultimately musical practices themselves." To conclude, let us turn to the words of Vincent Lostanlen one last time[130]:

"It is time to give up on the utopia of music being fully available, for everyone, everywhere, right away. (…) The streaming subscription model cannot be reduced to an individual consumption choice. In sociological terms, it is not a 'lifestyle' but a 'way of life' anchored in a system of values and norms. As such, the ecological debates over streaming will not abate because of efficiency gains – as, for example, better audio algorithms might lead us to believe. Rather than looking for solutions in technological innovation, it is more useful to build credible planning scenarios."

We adhere to the guiding principles of the European Network of Cultural Centers document[131]. Digital technologies raise questions about issues as fundamental as democracy, solidarity and the environment. It is imperative to deal with them directly in all their complexity, without considering them as secondary or optional.

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130 Lostanlen, V. (2023) op. cit., p.3
131 **European Network of Cultural Centres (2023) On digital ethics for cultural organisations**

What's next after this project?

With STOMP, we have sought to take stock of research on responsible digital technology and current practices in the music sector. Our focus has been mainly European, primarily targeting musicians from this region. Beyond these observations, and avoiding any technological solutionism, we wanted to suggest different avenues for reflection and action, which for the most part are still not widely known about, and which could define a more desirable and acceptable digital world.

Carried out as part of a 10-month project, this work requires further exploration. It is essential to continue the research, particularly with regards to musicians and users, and to understand the realities specific to each territory and context.

Through the publication of this document, The Green Room is also engaging in a process of dissemination. We want to share these tools, offer support and co-develop resources for musicians. Our objective is to raise awareness, inform and provide tools, in line with our missions and in collaboration with our partners and the networks to which we belong.

We would like to highlight the importance of music schools and popular education associations in the transmission, adoption, and potentially the co-creation of these tools.

The Green Room also plans to strengthen collaboration between the different actors around these highly political issues. We intend to rely on the initiatives of *Music Moves Europe* and *MusicAire*, and are continuing to speak with European authorities, including the European Commission.

Appendix

Glossary

Blockchain: technology for storing and transmitting data in a secure and decentralised manner.

Cloud: Remote data storage system via the internet.

Data centre: A place housing a number of data servers.

DSP: A Digital Service Provider provides digital music services (whether streaming, downloads, or both), via computer or telephone networks.

Free software: Distributable programs, the source code of which is accessible and modifiable by everyone.

GHG: Greenhouse gas, i.e. contributing to this phenomenon.

ICT: Information and communication technologies.

Life-cycle analysis / LCA: A Life Cycle Analysis is the multi-criteria study of the environmental impacts of a product or system.

Proprietary software: Proprietary programs, non-modifiable.

Rebound effect or the "Jevons paradox": phenomenon observed when the savings expected from the use of a technology or a more efficient resource are not obtained, or even results in over-consumption.

Server: Tool hosting and providing data, which can be hardware, software or virtual.

Surveillance capitalism: Exploitation of data for profit.

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List of interviewees

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Kyle Devine, professor at the department of musicology, University of Oslo, Norway. advisory board member of Evolution Music, scientific advisory board of Earthpercent | NO

James Dove, carbon literacy trainer for Climate EQ, Greening of Streaming I GB

Anna Dungal, events team for Iceland Airwaves & Sena Live, founder of OK Agency I IS

Louis Favre, associate director at TradeSpotting I FR

Céline Garcia, artist manager, co-founder and managing director of Puppet Master I FR

Emily Gonneau, founder and director of Unicum Music and Nü Agency, founder of Causa, president of La Nouvelle Onde and co-founder of Change de Disque I FR/GB

Alayna Hugues, creative technologist, musician and manager of Curiosibot I US/ES

Aysha Hussain, Keychange Coordinator, Human Resources Executive at Film London, freelancer I GB

Fabrice Jallet, head of entrepreneurship and incubation at Bliiida I FR

Lewis Jamieson, director of Communications and Industry Relations for Music Declares Emergency I GB

Karolina Juzwa, artistic director of Summer Jazz Academy Festival, booking manager of Wytwornia venue and initiator and curator of Intl Jazz Platform I PL

Anne Le Gall, cofounder and managing director of TMN Lab I FR

Bela Loto, president of Point De M.I.R and partner of M.I.R conseil & formation I FR

Mathilde Neu, founder & CEO at Resonance I FR

Maud Pouzin, artist manager, independent press officer and co-founder of Warrior Records I FR

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