Extraction, Cloud, Waste: electronic-literature as a catalyst for our internet eco-material awareness

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ABSTRACT

In this article, I contextualise the role of e-lit in order to address, through three case-studies and projects, the environmental implications of digital growth and progress. These projects correspond to three life cycles of the internet's materiality: extraction, optimisation — or cloud, — and waste. The first project is a minimal speculative text operating system directly booting from the ground. Taking the counterpoint of our dominant tropes of digital weightlessness, it sheds light on the geological nature of our technological devices. The second project is a platform poetry machine: stretching and making tangible through dial-up modems the embodied logics hidden behind our platform's minimal aesthetics. The third explores the materiality of e-waste: exploring how sensitive data can be retrieved from our electronic discards. Using these three projects, I argue for the importance of e-lit as a catalyst shedding light, through arts and design methods, on the materially situated characteristics of the digital.

KEYWORDS

e-waste; poetry machine; digital materiality; data storage

RESUMO

Neste artigo, contextualizo o papel da literatura eletrónica na abordagem, através de três estudos de caso e projetos, das implicações ambientais no crescimento e progresso digital. Estes projetos correspondem a três ciclos de vida da materialidade da Internet: extração, otimização — ou nuvem — e resíduos. O primeiro projeto é um sistema operativo básico que processa texto quando ligado diretamente ao chão. Tomando como contraponto dos nossos tropos dominantes que atribuem uma ausência de peso ao digital, este projeto enaltece a natureza geológica dos nossos dispositivos tecnológicos. O segundo projeto é uma plataforma que funciona como uma máquina de poesia e que permite o seguinte: ampliar e tornar tangíveis através de modems dial-up as lógicas incorporadas que estão por trás da estética minimalista da nossa plataforma. O terceiro projeto explora a materialidade do lixo eletrónico: explorando como dados sensíveis podem ser recuperados a partir dos nossos detritos eletrónicos. Utilizando estes três projetos, defendo a importância da literatura eletrónica como reveladora das características materialmente localizadas do digital através de artes e métodos de design.

PALAVRAS-CHAVE

lixo eletrónico; máquina de poesia; materialidade digital; armazenamento de dados

INTRODUCTION

Digital growth and progress is often depicted in our mainstream sociotechnical discourses as weightless and non-materially situated, i.e. disconnected from the earth and its circuits of extraction, optimisation and recycling/discard. Inside our western and euro-centric sociotechnical cultures, understandings around the internet are therefore structured around two dominant storylines (Hajer, 1997) framing on a daily-basis our sociotechnical interactions: the internet "cloud" and the electronic "waste". In this contribution, I propose to take the counterpoint of such narratives and tropes through the case of electronic literature (e-lit) projects: engaging with text as a raw material in computational or interaction design contexts. Shedding light on the environmental and material implications of the internet through a body of art and design research projects located at the periphery of this field, the article extends from the Open Systems Interconnection (OSI) model, the seminal technical diagram used by engineers and internet service providers (ISPs), to address its materiality. By doing so, it focuses on three core aspects of the internet's material implications referred to in the article as 1) extraction, 2) cloud, 3) recycling/discard. The contribution disentangles these three frames by placing in dialogue e-lit projects with a network of theoretical framework and references. These emerge from researchers working in the grey zones where our internet sociotechnical practices are inquired in the light of the broader Capitalocene (Moore, 2015) era we live in. At the level of our practices of extraction, the paper expands, first, from the work of Martin Howse entitled "earthboot" (Howse, 2014). As a data transmission assemblage where computing and the earth intertwine, the contribution connects the work of the artist with its broader theoretical context. This context is the geological implications of computing. In other words, it is the dependance of our computational culture on a substantial amount of geologically-situated raw materials and metals required to produce its physical layer: modems, routers, servers, undersea-cables, and so on. The second section, debunking the metaphor of the cloud, starts from Cyrus Khalatbari's project titled *2X* (Khalatbari, 2017) which takes the form of a dial-up modem apparatus and network that combines analog signals with poetry making. The article

contextualizes this project in the light of a body of references, making visible the political and environmental implications of our cloud-enabled digital practices, implications obfuscated by the seamless metaphor. Finally, this contribution addresses the theme of discarded electronics/recycling at the level of the Forensic Fantasy Trilogy (Kairus, 2016) from the art collective Kairus. This project consists in a forensic re-appropriation and dives into the textual and multimedia materialities of "trashed" hard drives found in Ghanaian electronic waste (e-waste) landfills. Subverting these hardware discards in order to ask foundational questions about the ecological footprint of our digital practices, the contribution uses this piece as a catalysis to shed light on the planetary circuits of second-hand computers, whether repaired, recycled or transformed in countries of the Global South. From Howse to Khalatbari and Kairus, this article argues for the potential to bridge e-lit with critical and speculative design frameworks in order to address, through arts and design projects, the environmental implications of our digital practices.

1. EXTRACTION: HOWSE'S ENVIRONMENTALLY-SITUATED "EARTHBOOT" (2004)

"Human history is infused in geological time" (Parikka, 2015, p. 6)

In order to start disentangling the first e-lit project mentioned above, it is crucial to start with interfaces and applications we interact on a daily basis, as for instance, the OSI (Open Systems Interconnection). In the context of Howse's project, these interfaces are operating systems (OS) we use daily. Circling back to the map of the internet as stacked in the OSI model, the OS is crucial because it makes possible the transition between the physical and the digital, acting, in short, as the foundational layer enabling us to run and operate user applications on our computers. The OS is therefore, in other words, the first interface we access as users and that allows us to interact with our devices and perform a variety of actions ranging from processing data and files, going on the internet, and so on. After users press the on button the computer *boots*. The action of booting launches the OS, displaying the Graphical User Interface (GUI) of the laptop. As a reference to this process, Martin Howse's project is called "earthboot" (Howse, 2004) [fig. 1]. The project is composed of two main aspects. First, it has a custom-made sensor-hardware, plugged into the artist's computer — in this case, a black Lenovo Thinkpad. This hardware device is like a male electrical outlet plug similar to the ones we use on a daily basis. However, rather than wired to an electric circuit, it is meant to be directly plugged into the ground, or into the earth, as the project's name suggests. On the computer, a custom-

made (minimal) OS is installed, reacting to the sensor. When the device is then physically attached to the ground, it therefore sends signals to the OS. These signals correspond to the telluric activity of the soil where the plug is inserted. When the "earthcode" is received, the OS flickers and glitches for a few seconds, and then stops working. The OS, however, displays a GUI that depends on the various telluric signals received as inputs. The project is site-specific. This means therefore that, based on the nature of the telluric signals inputted from the ground, the OS will configure its GUI differently, positioning its letters and colours in ways that are dependent on the received values. Howse's project is a speculative design proposition. Here, the term draws from the work of the designers Anthony Dune and Fiona Raby, who coined and developed the concept in their seminal book titled: *Speculative Everything: Design, Fiction, and Social Dreaming* (2013). Rather than using design and technology in order to follow a solution-oriented approach, Howse's project aims to ask foundational questions about the nature of computing and our computational processes. More specifically, it proposes to *speculate* on the near-future (Bleecker, 2009) of technology in the light of the social, political and ecological trajectories and forces at play in the world we live in. By taking an open-ended posture, it is polysemic and provokes, in a radical and poetic manner, its audience on alternative yet plausible (Auger, Smyth, Helgason and Hanna, 2019) embodiments and developments of our day-to-day technologies. Through this provocative project, the piece tackles a core aspect of our computational culture: its environmentally-situated nature (Nova, 2021). This conversational piece (Bleecker, 2009) asks us to shift our perspective to the internet and our digital processes at the level of the "earth layer" (Bratton, 2015): the assemblage of fluxes, forces and modulations emerging from the inner activity and processes of our planet. Using text as the raw (glitching) input inside this speculative OS, Howse's piece asks us to further investigate the intersections and frictions between the earth and the internet megastructure. Moreover, one step closer to the metal (Rella, 2023) of our computing culture, the piece echoes what the technology scholar and theorist Jussi Parikka frames as geological media (Parikka, 2015). In this context, Parikka proposes to extend from the work of the German media theorist Frederich Kittler, starting from the provocation that "there is no software" (Kittler, 2014). Instead of approaching media as *digital*, Kittler proposes then to recenter our analysis of these apparatuses on the technical and material assemblages that structure them. These assemblages are located at the level of the OSI's physical layer. They are the tangible "stuff you can kick" (Parks, 2015): modems, routers, antennas, wires, server-racks, the list goes on. From this standpoint, Parikka's inquiry aims to connect media analysis one step further to its atomic nature: at the level of the raw metals and minerals

that constitute it. From gold and tantalum used in our printed-circuit-boards (PCB) capacitors to germanium, foundational for the production of our fibre-optic cables, these metals are geologically and environmentally situated: they are extracted in specific countries around the globe on which we depend. A tangible example of this is the urgent case of rare-earth minerals we increasingly need to further develop our so-called *digital* and *green* technologies. As analysed by Guillaume Pitron in his book titled "The Rare Metals War" (Pitron, 2020), the location of these required metals — mainly located and *extractable* in China[1] — sets a new geopolitical foundation shaping the near-future of our computational culture. In other words, by being scarce metals substantially centralised in China — and depending then on China's regulation and policies — these metals used to manufacture our computers reveal the geologically and environmentally-situated nature of computing. This foundational characteristic of computing echoes here with Howse's speculative proposition. Where the physical location of these metals impact the production lifecycle and making of our technological devices and hardware[2], the artist aims to speculatively extend this reality at the level of the connection between the geological and the software/user-experience. With his OS that is environmentally (or tellurically) situated and boots differently, depending on the characteristics of the soil where the custom-socket is inserted, the project invites us to investigate the geological implications of our desires of digital growth and progress. Where scarcity in metals can impact the production of our devices and in turn our end-user activities, Howse reminds us of the dependance of our computing culture on a finite set of metals that are only found in certain areas of the globe. What is more, expanding on art and design methods, with his research on psychogeophysics[3], the artist invites us to reframe how, in a world mediated by technology and sensing machines, the earth-emerging materiality of these devices have an impact on the way we inhabit the world.

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1   More information about the metric tons of China's extracted metals can be found in this 2018's global report.

2   This is explicit with the emergence of private-based actors such as koboldmetals, offering alternatives to conflict minerals only extracted in countries at war and with unstable conditions.

3   Developed by Howse at the The London Psychogeophysics Summit (Howse, 2010), this speculative design concept extends from psychogeography in order to analyse and situate how processes emerging from the earth and its geophysics have an impact in the way we perceive the world and situate ourselves.

2. CLOUD: KHALATBARI'S ZOMBIE-MEDIA *2X* (2017)

The word 'cloud' speaks to the way we imagine data in the virtual economy travelling instantaneously through the air or 'skyway'—here in California one moment, there in Japan the next. (Hu, 2016, p. xvii)

Below our applications and interfaces, the OSI adds another layer to the internet cartography: web protocols. These protocols, rendered opaque by the cloud, are the focal point of Cyrus Khalatbari's *2X* (2017) [fig. 2], the second project that enables us to contextualize the role of e-lit projects in demystifying the blackbox (Latour, 1999) of the internet. The project takes the form of three operating computers connected through dial-up modems: the (iconic) analog data transmission process of the AOL internet era we used in order to establish protocol connections. When the piece is running, two computers are transmitting (or encrypting) data through the modem signals; the last one is receiving (or decrypting) these signals. These signals are coming from X and are imputed to the transmitting computers through the platform's API[4]. More specifically, these are X's streams: real-time data of the platform's post containing specific keywords the program is asked to listen to. In the project, the keywords are "BBC" and "CNN", both assigned to one computer. When the project is launched, the software connects to X through its API, listens to all the "BBC" or "CNN" streams, and sonifies these streams in (loud) modem signals. The crucial aspect of the project is the following: these signals are transmitted at the same modulation parameter. When they are outputted through the computer speakers to the physical space of the project, they are intertwined together, forming one same signal where both the BBC and CNN streams are combined. On the other side of the modem network, the receiving computer is also set at the same parameter. Recording the loud signals through its microphone, it decrypts everything back into one chain of words. At each 280 received characters, it sends these words back to the platform. Connected also to the (posting) X's API, it activates a command to generate a new post on the platform. The last published post with semi-gibberish semi-legible English words is nicely formatted according to the platform's aesthetic and design. Experiencing the project feels in turn both cryptic and driven by an underlying computational logic automating the posting loop and process. At the heart of the project sits, in other words, a tension: experiencing both the loud screeching modem sounds and the platform's light aesthetic with the embedded post shown on a light grey

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4   APIs are a crucial component and strategy of the private-based corporations' platform seamlessness, digital growth and expansion. The underlying logic of these software can be found in this article.

background. Where Martin Howse's project connects to the speculative design framework, the *2X* echoes with the ones of adversarial design (DiSalvo, 2021) and "zombie-media" (Hertz and Parikka, 2012). Adversarial design draws from the work of Chantal Mouffe on agonism (Mouffe, 1999) and is presented as the crucial condition for contestation required for the well-being of our democracies. Drawing from Mouffe, DiSalvo's concept extends this need to design practices, arguing that design can also be used to challenge dominant beliefs and narratives of our (sociotechnical) cultures. One of the beliefs and narratives the project debunks and critically addresses is the one of the internet cloud: the metaphor wrongly depicting the network as weightless and as a purely digital object we observe from afar. It debunks this narrative through the making of a zombie-media (Hertz and Parikka, 2012) network. Zombie-media is, according to Barbrook and Cameron, a method and strategy taking the counterpoint of the dominant Silicon Valley's "Californian ideology" (Barbrook and Cameron, 1995) in which technology is always depicted as new. Taking a critical perspective on these values embodied in the design of platforms we use on a daily-basis, zombie media propose to entangle inside the same material context different technological and temporal regimes. In *2X*, this critique takes the form of a dialogue: between the platform's cutting-edge and minimal aesthetics — depicted by the embedded post — and the obsolete modem data transmission protocol. This project invites us to "unblackbox" and eliminate the opaqueness of the internet cloud at the level of three core aspects. The first one emerges from the intention to poetically exploit (Galloway & Thacker, 2007) the modem protocol. While our internet protocols are hidden and running seamlessly in the background of our data transmission processes, the project is centered on and relies on the logics of the dial-up modem, in other words, its ability to sonify two data streams at the same modulation parameters. By doing so, the project proposes to "re-politicize" (Hertz, 2009) our internet protocols depicted as exterior to our interactions by the cloud metaphor. In other words, it sheds light on the fact that the network of internet protocols hidden behind our screen interfaces are not simply technical but also political and normative[5], following embodied logics that structure our day-to-day interactions. The second aspect the project intends to debunk is the belief that our data transmission processes do not have temporalities. In addition to the metaphor enacting the impression of instantaneity (Hu, 2016), this illusion is also crafted at the level of the software our interactions rely upon: optimizing processes through a series

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5 This normativity imposing on us specific embodied ways to interact with data is tangible in the context of the net.neutrality, where information access is regulated – or denied – at the level of these protocol's embodied logics.

of sliced micro-temporalities and chopped data packets (Soon, 2017). Taking a critical standpoint on these logics, the project proposes here to stretch these barely perceptible processes through the use of the dial-up modem. Where these processes are hiddenly and silently running in the background of all our internet interactions, *2X* makes audible the platform's packets and streams. By doing so, it reveals the seams (Ratto, 2007) used by these platforms for connectivity. It invites us to reframe and debunk the storyline of "new-media" in the light of the history of the internet: composed of temporal, error-prone and unstable analog apparatuses such as the dial-up modem. The third and final aspect the project debunks is the one of the digital realm, and the immateriality of data. Drawing from the media historical (and genealogical) work of Hu retracing origins of data servers — inherently linked to the cloud metaphor — to cold war bunkers (Hu, 2016), *2X* aims to hijack the dominant narrative of these spaces as shown by images originating from internet service providers (ISPs) private-based actors. Data servers have a (hidden) history of being error prone, noisy and substantially analog[6], and this project serves as an alternative to cloud platforms. While mainstream pictures of data servers *feel* silent and omit sounds and sizzles of computers in activity, the project performs the opposite. It entangles the production (and aesthetics) of our platform's posts with devices that are explicitly analog, noisy and error prone.

3. WASTE: KAIRUS' CRITICAL UNMAKING "FORENSIC FANTASIES TRILOGY" (2016)

> *"The sedimentary layers of waste consist not only of circuit boards and copper wires, material flows and global economies, but also of technological imaginings, progress narratives, and material temporalities." (Gabrys, 2013, p. 4)*

At the bottom of the OSI's cartography, the physical layer acts as a ground. It is from this layer that the third project of this contribution emerges. This project arguing for the importance of e-lit in critically tackling eco-material implications of computing emerging from our Capitalocenic (Moore, 2015) era is entitled "forensic fantasies trilogy" (Kairus, 2016). Created by the arts and design research collective Kairus, it consists of both an exhibition where various arts and design artefacts are shown: texts, image profiles, a book, and a printed letter. These artefacts gravitate around one technical object: the hard drive. These hard drives are originating from

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6 The sonic characteristics of data-centres is, amongst other examples, shown in this video by Cisco, a major internet service provider and company.

a well-known location inside our planetary circuits of electronic waste: the landfill and processing site of Agbogbloshie, Ghana. Labelled by western and euro-centric news agencies as the biggest computer graveyard in the world where our computers *go to die*[7], Agbogbloshie is a symbol of the hazardous[8] human and material consequence of our needs and desires for digital growth: e-waste dumping and planned obsolescence. Drawing from this context, the project is a forensic inquiry into the software materiality of trashed (Sterne, 2007) hard drives. More specifically, the project consists of six hard drives found on the landfill in which data from their initial users has been recovered. From texts to images and social media profiles, the data found by the collective is then creatively repurposed in the context of three iterations. Amongst these three iterations stands the one entitled "Not a Blackmail" (Kairus, 2016). Drawing from the found data of these hard drives, this proposition takes the form of a ready-to-be-posted letter and package intended for the hard drive's initial owner, and containing personal information gathered during the object's forensic inquiry. This sociotechnical (and aesthetic) relationship occurring between the storage system and the letter shows that the hard drive, as one of the objects materialising our computational culture, is not just technical. It is, in other words, both technical, social and political: enacting a specific way to format and keep a *material* trace of our data that can then easily be retrieved and used for a variety of new contexts. This displacement and reappropriation of our trashed devices is also explicit in their project's iteration entitled "Identity theft" (Kairus, 2016), which addresses how these discarded devices containing sensible information serve as a base for fraudulent economic practices of scamming. Through this project, e-lit connects with a body of arts and design methods referred to as critical making (Hertz, 2009) — or unmaking (Gaboury, 2018). Both developed as systemic approaches to folding critical reflection into the practice of technology design (Sengers et al, 2005, p.4), the Kairus collective uses practices and techniques emerging from technology unmaking, re-making and repairing in order to further debunk and demystify, at the level of our trashed hard drives, our planetary circuits of electronic waste. Addressing these issues through a combination of text and media artefacts, the idea behind Kairus' project is not to deny the environmental impact of these landfills, but to nuance dominant narratives of landfills as dumping sites where computers simply *go to die*. At first, it connects with the seminal concept of urban mining, developed

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7   This erroneous belief is conveyed by articles of major media outlets. Examples contain this WIRED article or this publication by the BBC.

8   A global survey of the hazardous impacts of our global e-waste circulation and processing can be found in this article.

in the context of Agbogbloshie and Ghana by urban studies scholars such as Richard Grant and Martin Oteng-Ababio (Grant & Oteng-Ababio, 2016). Urban mining expands from mining activities where, as introduced in our first section, precious metals are extracted from the ground. However, located at the supposedly final stage of our technological products lifecycles, electronic waste landfills — or processing sites —enables us to understand how, by contradicting the "dumping" narrative, value is extracted from our *trashed* digitals. It enables us to situate devices circulating inside the planetary circuit of e-waste as connected to a body of economic activities and circuits: whether extracting back copper, gold, aluminum or, as in the project, data. In Kairus' project, this circulation between trashed hardware and the making of new sociotechnical contexts originating from these devices connects with the work of Jenna Burrell on "invisible users" (Burrell, 2012). Burrell, anchored in the Science and Technology Studies (STS) field, starts from one object and context: Ghanaian cybercafes. Taking also here the counterpoint of the e-waste dump dominant trope, the author's inquiry maps how electronic devices trashed by the global North in a logic of planned obsolescence are creatively repurposed and resituated through a body of new techniques and new sociotechnical computational contexts. Moreover, by focusing on cybercafes, Burrell disentangles how computer parts coming from the landfill are then repaired, reshuffled, remixed and reassembled in order to (re)make functioning devices. As an echo with the project and its critical exploration on practices of online identity theft and scamming, Burrell makes visible, in other words, how objects we understand in our Global North countries as *trashable* are used as starting points for new digital contexts. Where parts are used as materials for remaking cybercafe's computers in Burrell's work, Kairus' work informs us how other forms of profits such as online scams are occurring and originating from devices we consider as *dead*. Finally, from cybercafes to online scams or pans made from urban-mined aluminum, this manipulation — and subversion — of our old computers outside of the Global North's common uses and practices around technology also connects to the writings of DK Osseo-Asare and Yasmine Abbas around 3E materials (2015). In this context, the two scholars and designers propose to shift our understanding of computational debris from the way they are commonly perceived: Electrical and Electronic Equipment Waste, or e-waste, is replaced by Electrical and Electronic Equipment (EEE or 3E). By shifting our focus away from the notion of waste that, as mentioned in the introduction of this paper is a structuring force in the context of planned-obsolescence, Osseo-Asare and Abbas invites us, like Kairus' project, to better understand the afterlives of our digital objects. Both at the level of the two authors or the art's collective, we are invited to reframe our obsolescent technological devices as inherently linked to subversive

techniques of recycling and reappropriation, thus nuancing our discourses around the weightlessness of our digital practices.

CONCLUSION

In the article, I contextualized the role of e-lit within the broader landscape of critical and speculative design frameworks in order to address, through arts and design projects, the environmental implications of our digital practices. In order to nuance and take the counterpoint of our dominant storylines and narratives around digital weightlessness, I shed light on three layers and life cycles of our internet materiality. From this perspective, I expanded on the Open Systems Interconnection (OSI) model: the seminal technical diagram used by engineers and internet service providers (ISPs) in order to frame the underlying operational and technical objects of our internet practices. From this standpoint, I structured this claim around three states —namely, extraction, cloud, waste—, upon which I situated the role of e-lit in order to contribute through arts and design projects to our broader debates around environmental media.

The first project I tackled is one of Martin Howse's environmentally-situated "earthboot" (2004). With its speculative text-based operating-system (OS) reacting to telluric variations and fluctuations of the soil, I explored the connection between e-lit and Dunne and Raby's speculative design (2013). This enabled us to shed light on the role and potential of the field in asking foundational questions about the geological characteristics of our technological devices. The second project I explored is Cyrus Khalatbari's *2X* (2017). Stretching and making tangible, through dial-up modems, the hidden logic of the network of data transmission protocols structuring our daily digital practices, I nuanced the metaphor of the cloud as an opaque, powerless, and purely technical object. Starting from this primitive data transmission technology of our early internet stages, I took the counterpoint of our internet and datacenter's seamless and minimalistic aesthetics. With the use of Hertz and Parikka's zombie media (2012), I retraced the temporal, analog and error prone history of the internet. Drawing from DiSalvo's adversarial design (2015), this enabled us to critically question through design these dominant narratives of seamlessness and weightlessness emerging from the metaphor. Finally, I explored the connections between e-lit and e-waste reappropriation. At the level of Kairus' forensic fantasies trilogy" (2016), I shed light on how the materiality — and material inscriptions — of our technological devices driven by planned-obsolescence are detoured in new sociotechnical nuancing our western and euro-centric narratives of e-waste *dump.* Combined with Ratto's critical making (2007) or Gaboury's

critical unmaking (2018), I expanded and reframed our understanding of the eco-material implications of the digital. In the present article, these three projects enabled us to argue for the potential of the e-lit discipline as a catalyst shedding light through arts and design methods on the materially-situated characteristics of the digital.

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